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NAME OF AUTHOR/*NOM DE L'AUTEUR* KEYS, CHARLES LAWRENCE

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NAME OF SUPERVISOR/*NOM DU DIRECTEUR DE THÈSE* Dr K.J. FAIRBAIRN

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DATED/*DATÉ* 4 APRIL 1975 SIGNED/*SIGNÉ* CLKeys

PERMANENT ADDRESS/*RÉSIDENCE FIXE*
Department of Geography,
University of Wollongong,
Wollongong N.S.W., AUSTRALIA 2500

NL-91 (9-74)

THE UNIVERSITY OF ALBERTA

SPATIAL REORGANIZATION IN A CENTRAL PLACE SYSTEM: AN ALBERTAN CASE

by

© CHARLES L. KEYS

A THESIS

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled SPATIAL REORGANIZATION IN A CENTRAL PLACE SYSTEM: AN ALBERTAN CASE, submitted by Charles Lawrence Keys in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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Supervisor

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External Examiner

Date ....March 26 1975....

ABSTRACT

Geographers and other social scientists have carried out many cross-sectional studies of systems of central places, but little is known regarding questions of how such systems evolve, develop and change over time. Most of the literature which has addressed these questions has employed a comparative statics approach in attempting to predict rates of growth and decline in the population sizes of trade centres. While this approach has provided some insights into patterns of change, it can contribute little to our understanding of the processes which are active in creating structural reorganization in central place systems. This thesis attempts to remedy these deficiencies.

A holistic system of central places organized around the city of Red Deer (Alberta) was chosen for study, and data were assembled from which changes in the hierarchical and spatial structure of the system since 1941 could be described. Analysis of change was undertaken at two scales: the aggregative level of the system as a whole, and the elemental level of its member places. The traditional comparative statics approach was employed, and in addition an attempt was made to model some of the processes thought to be active in differentiating the rates of growth and decline of central places.

The trade centres, most of which were very small, were found to be competing for trade. Centralization, both of trade and of functions, was occurring, and many of the smallest centres were

disappearing from the system. Most of the centres still existing in 1971 are considered likely to lose trade in the future. While much reorganization is apparent, the pace of change has been slow given the degree of increase in the mobility of consumers that has occurred.

It was difficult to predict with any accuracy the growth performances of the central places. Large places were more prone to growth than small, and places situated on paved roads were less likely to lose trade than were centres located on roads of lower quality. Other factors identified as differentiators of growth performances were location within the study area, population trends in the local region and distance to major centres. The process approach to explanation was not productive of further generalization, however. The shrinkage of space did not appear to affect the growth prospects of central places in the manner anticipated, and there was no evidence of patterns of change consistent with the spatial radiation of competitive impulses from growing centres. Given the extreme difficulties associated with identifying and measuring the processes operative in central place systems, the outlook for future empirical research in the field is not bright.

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CHAPTER I

INTRODUCTION

Like cities themselves, systems of urban places are constantly undergoing change through the interplay of internal and external forces. While this has long been recognized as axiomatic by geographers and other spatial scientists, the realization of the importance of processes of change has not, by and large, been embodied in spatial theory. Most of this theory (including Christaller, 1966; and Lösch, 1954) attempts to portray the configuration of spatial systems at single moments in time. Empirical research on spatial systems has tended to follow the example set by the theorists: work has been concentrated on the products rather than the processes of change. Hence the literature of geography is replete with studies of the relatively low-order problems of spatial structure and functioning, but contains little on the conceptually more difficult problems of the dynamics by which systems develop (Berry, 1964, p. 10). Fortunately, however, there is growing evidence of a realization by geographers of the need for process-orientated research strategies as means of identifying sources of order and disorder in spatial organization. In fact, it might be said that at least as important as the general acceptance during the 1960s of quantitative methodologies was the growth of interest among geographers in the search for and examination of spatio-temporal processes. In particular this interest has been spearheaded by the methodologists within the discipline (Ackerman, 1958; Blaut, 1961; Harvey, 1968; 1969), and has borne fruit in the work of the rapidly-developing behavioural school as well as in the more traditional approaches to economic and urban geography. Yet to date the process studies have tended not to rise above the conceptual level, attempting generalization but placing little emphasis on theory-building in the formal sense. Certainly they have not yet provided an integrated dynamic location theory of the stature of the existing body of "timeless" theory of spatial structure. This is scarcely surprising given the difficulties accompanying such a formulation. Because the processes underlying spatial patterns are not clearly discernible in those patterns, and because processes are rarely operative in a simple, deterministic cause-and-effect manner, our understanding of the nature and role of pattern-inducing mechanisms remains "no better than rudimentary" (Prince, 1971, p. 22). Without a continuing emphasis on the processes which generate change, however, we are unlikely ever to formulate a meaningful dynamic location theory.

THE GENERAL CONTEXT

This thesis focuses upon certain of the processes operating to produce alterations in a particular spatial system, the set of central places subordinate to Red Deer in south-central Alberta. In any real-world social or economic system, the forces leading toward change are complex, as are the systems themselves. To overcome these complexities, the accepted research strategy is to reduce the scope of individual studies to certain aspects of more all-encompassing problems. This simplification may be achieved in either or both of two ways. Firstly, the system which is to be the object of examination may be selected on the basis of its functional character. The voluminous literature which was stimulated by the publication of Christaller's central place theory provides a case in point. Work in the field has generally focussed on systems of urban places whose functional make-up excludes as far as possible the distorting influences which would be produced by the presence of non-central activities (see, for example, Berry and Mayer, 1962). While this mode of simplification has led to a heavy emphasis on the tertiary sector at the expense of other sectors of the economy (Jeffery, 1970, p. 1), the approach has proven more manageable and more productive of theoretical generalization than the holistic one and can be justified on these grounds. Secondly, simplification of the study situation can be achieved by concentrating attention on only a few of the myriad processes acting to form the existing character of the system under observation. If this strategy is to be followed, of course, it is incumbent upon the researcher to provide justification for the choice of processes whose role in system development or reorganization is to be examined.

Existing theory on change in (or development of) spatial systems has followed both of these simplifying approaches. For example, Janelle (1969) has proposed a conceptual model for spatial reorganization which is consequent upon the shrinkage of space brought about by new transportation technologies. Janelle's concern is with the changing time values which may be ascribed to geometric distance, and other factors relevant to the process of spatial reorganization are excluded from consideration. Others have concerned themselves with certain types of spatial system. Taaffe, Morrill and Gould (1963), for example, have examined the processes at work in the temporal evolution of systems of ports, and their model has received support from the research of Rimmer (1967a, 1967b) in Australia and New Zealand and Trindell (1966) in colonial North America. Hudson (1969) has proposed a spatio-temporal theory of rural settlement based on the biological analogue of colonization, reproduction and space-competition, while Whebell (1969) has developed a model to explain the existence of temporal differentials in urban growth in a particular type of spatial domain--the corridor.

Others again have adopted more classical approaches to the study of change in spatial structure (Curry, 1969; Neutze, 1967; Nourse, 1968). Of these, Curry attempts to introduce the variable of inter-place competition into a system of places developing according to Christallerian principles, but concludes that "the postulates of classical location theory, while they do allow steady growth of the central activities of the spatial economy, are not very useful to central place analysis in the dynamic case" (pp. 281-282). In this case the difficulty arises because new entrants to the central place system disturb the quasi-equilibrium situation forged by the existing places. As a result, a shuffling of locations becomes necessary for the system to regain its previous level of locational equilibrium. It would appear that classical central place and competition theories, because of their equilibrium biases and the lack of realism underlying their assumptions, do not provide a useful starting point for the development of models incorporating the dynamism of spatial structure. If classical theory cannot be used to generate such models, theorists are left with only mathematical approaches such as, for example, the use of differential equations (Harvey, 1969, p. 427; King, 1966). Such approaches, however, appear to be overly deterministic given our present inadequate knowledge of process. A more important goal for research at the present time would appear to be a concentration on a search for the actual processes which contribute to spatial organization.

The processes which operate to produce structural change in spatial systems are numerous and complex, and tend to vary according to type of system. In discussions of central place systems it is convenient to divide the forces for change into two groups: those concerned with the supply of, and those concerned with the demand for, central goods and services (see Siegel and Woodyard, 1974, pp. 75-76).

Demand

Demand characteristics are those which relate to the support given by consumers to the establishments present in central places. Given a particular level of support for each establishment in a system at a certain moment in time, it is a simple matter to envisage the means by which these support levels may change. Any forces which operate to alter (a) aggregate demand for the services offered, (b) the distribution of total demand over the services, or (c) the spatial pattern of consumers' demand-satisfying behaviour, will alter the level of patronage given to the central establishments of individual member places. Historically, increasingly higher real incomes and standards of living have produced higher levels of aggregate demand in Western societies. But this upward trend in demand has not affected all central goods and services equally. Rather, there has been a proportionate decrease in the consumption of those basic, day-to-day necessities characterized by low elasticities of demand, and a corresponding shift toward convenience and luxury items of higher order (this finding was first articulated by the nineteenth century German economist Engel and is known as Engel's law. See Stigler, 1954; and for cross-cultural evidence supporting the proposition, see Houthakker, 1957). This shift in the distribution of total demand over the range of goods and services offered has been accompanied by a transformation in the spatial pattern of demand satisfaction in which consumers have travelled longer distances to those larger places in which their increasingly sophisticated requirements can be met. The time, money and opportunity costs of movement have been reduced by higher incomes, increased car ownership, improved routeways, faster vehicles and larger amounts of leisure time. As a consequence of this increasing freedom of movement the potential action space of the consumer has expanded greatly, allowing him a greater choice than previously of places in which to satisfy his needs for goods and services.

In rural areas, the impact on small central places of increased circulatory movement has been intensified by off-farm migration (Fuguitt, 1965a; Hodge, 1965a, pp. 29-36). Farm enlargement has promoted the movement of population toward the major urban regions in which new employment opportunities are increasingly to be found. Increasingly too in recent history, more people appear to have preferred to live in these regions, where the amenities of modern living are more immediately available than in the open countryside (Boskoff, 1962, p. 95; Deutsch, 1961, pp. 101-102). Although the effects of rural depopulation on total demand have been more than offset in some rural areas by increases in real incomes (Stabler, 1973, p. 20), the structure of total demand is progressively being altered. With fewer customers at their disposal, those establishments offering only everyday goods with low income elasticities of demand have tended to become less profitable, and many have been forced to close.

Supply

On the supply side, the present century (and particularly the period since World War II) has seen a virtual revolution in the forms of organization and the scale of operation of retail and other central activities. As is true also of the primary and secondary sectors, the tertiary sector has responded to an increasing need to achieve economies of scale. In the aggregate, firms have increased their scales of business and turnover, though in central place systems the change derives more from the characteristics of newly-entering establishments than from modifications to those establishments already existing. Central functions offering the increasingly sophisticated services of the present day tend to have high investments in plant, stock and overheads, and accordingly they require substantial markets to operate efficiently. They are therefore most likely to locate in those centres in which market accessibility is maximized--that is, in the larger central places.

The swing toward increased scale of operation has created alterations in modes of supply among distributing units. Early in the twentieth century the establishments of central places tended to be of small scale and offered a generalized mix of products or services. Nowadays, however, central establishments tend either to combine generality with size or to compensate for smallness by specialization of product. In the retailing world a new pattern of trade has emerged, in which sales are increasingly polarized between the mass merchandising, often chain-organized operations (department stores, supermarkets) on the one hand and the specialized boutique-like stores on the other (Davidson, 1970).

The traditional supply modes of central places are being forced out of the picture, primarily by the larger outlets which have mastered the competitive merchandising technologies of the modern era (Scott, 1970, p. 79). Smaller and weaker establishments, over-represented in the countryside as compared with the cities and towns and already suffering from the effects of rural depopulation and increased consumer mobility, have seen their viability further reduced.

Service activities, too, have undergone alterations in scale of operation and mode of supply. The once-common village doctor has disappeared from the North American scene, his function replaced by the city clinic which houses a number of medical specialists sharing the facilities which scale and agglomeration have allowed them to accrue. School and post office districts have been enlarged, again allowing the benefits of scale to be achieved.

While the general direction of change in central place systems is toward the increasing concentration of functions in larger places, some cases of functional devolution nevertheless occur. In general these are associated with the efforts of major retailing corporations to strengthen their competitive position over wider areas (see, for example, Rumball, 1973, pp. 56-57), though governmental, wholesaling and financial activities are also subject to decentralization (Holmes and Pullinger, 1973). Such devolution rarely if ever occurs throughout the hierarchy, however; recipients of branch offices, plants or stores of major firms are usually themselves relatively large and growing places (Thompson, 1965).

Overall, then, changes in supply technology have created a situation in which, as the minimum efficient size of a business type has increased, its function has tended to migrate up the urban hierarchy (Fox, 1962; Gilmore, 1953, p. 142). In general, the resulting structural reorganization of central place systems has been achieved by the addition of new functions at the upper levels of the hierarchy and by the demise of establishments lower down, but there are cases in which the operators of functions have themselves moved to new locations. The up-hierarchy movement of medical functions during the present century (Morrill, 1959, pp. 236-37), for example, has been accomplished in part by the migration of doctors and dentists to larger places (Benham _et al._, 1968; Mountin _et al._, 1945; Steele and Rimlinger, 1965, pp. 188-93). In this context less is known about entrepreneurs in retail activities, though it is probable that the relatively high fixed capital-to-earnings ratio that characterizes the distribution of goods tends to inhibit the movement of entrepreneurs from less viable to more viable locations.

Interaction of Supply and Demand

That supply and demand are circularly causal is, of course, a central tenet of economic theory. In central place systems as elsewhere, changes in the characteristics of supply create responses in demand patterns, and vice versa. Yet it is generally accepted that spatial and hierarchical reorganization in systems of service towns derives primarily from alterations in demand levels and demand-related behaviour, and that supply characteristics play a relatively passive role. Certainly at the macro-spatial level, it is usually assumed that "the pattern of retail supply responds to consumer demand through the processes of retail management in competitive economies. Variations in the characteristics of retail supply should thus reflect variation in the pattern of consumer demand" (Andrews, 1971, p. 12). Locational shifts of functions constitute changes in the spatial pattern of supply, but it can be argued that the shifts themselves would not have occurred were demand-related behaviour incapable of alteration. The increasingly city-based locational pattern of medical services and the decline in the practice of doctors visiting the homes of rural patients, for example, have resulted in a situation in which these patients have had to travel longer distances to obtain medical attention. Clearly, per capita consumption of medical services would have fallen had not the conditions allowing increased travel been present. Similarly the progressive replacement of the rural grocery store by the supermarket could not have occurred without the trend toward increasing consumer mobility. The supermarket has a higher threshold than the grocery store, and, other things being equal, must draw custom from greater distances to be profitable.

Change in the locational pattern of distributing units, then, is in large part a response to changes in demand-related behaviour, both actual and potential. Once occurring, however, locational change further alters behaviour by altering the set of alternative choices offered the consumer. Since the general trend has been for individual goods and services to be offered at higher minimum levels in the hierarchy than formerly, the tendency for consumers to travel greater distances to obtain them has intensified. But the supply schedules of central places, while in part conditioning movement behaviour, may also and at the same time lag behind that behaviour. The increasingly common phenomenon of bypassing, whereby consumers forego opportunities to purchase goods in order to obtain them at more distant locations (Rushton, 1969), suggests that existing distributions of opportunity do not closely reflect existing realities of behaviour. Supply and demand, while interactive, are not perfectly so.

EMPIRICAL LITERATURE ON REORGANIZATION WITHIN CENTRAL PLACE SYSTEMS

One type of spatial system whose dynamics have received considerable attention, particularly from geographers, economists and rural sociologists, is the system of central places.[1] The literature which has accumulated is highly diversified with respect to aims, conceptual and technical sophistication and the functional and scale characteristics of the systems under examination. Partly because of this diversity, considerable confusion has been engendered as to the trends identified, particularly as regards the growth performances of the smaller trade centres and the relative locations of growing and declining places. Almost invariably the strategy has been one of collecting, for two (occasionally more) dates, information by which the changing status of each place may be gauged. In most cases status has been equated with population size, although some students (Hodge, 1965b; 1966a; Stabler, 1973) have preferred the use of indices of functional magnitude or complexity. Change in status is treated as the dependent variable, and correlation-regression methods or contingency table descriptions of relationships are employed in an effort to explain it.

---

[1] The following list is suggestive rather than exhaustive. See: Anderson (1967); Borchert and Adams (1963); Butler and Fuguitt (1970); Daly and Brown (1964); Fuguitt (1965b); Hart and Salisbury (1965); Hassinger (1957a; 1957b); Hodge (1965b; 1966a); Lively (1931); Mattingly (1963); Nelson and Jacobson (1941); Salisbury and Rushton (1963) and Stabler (1973).

Taken together, it is contended, these empirical studies have contributed to our understanding of the structure of change in particular areas, but have provided little in the way of generalization about either processes or patterns of structural reorganization in central place systems. In part this failing derives from the lack of an adequate theoretical base from which empirical work has proceeded, but it stems also from inadequate conceptualizations of the nature of change and the processes involved in change. These criticisms are elaborated in the following paragraphs.

The Nature of Change

The initial problem in research into the growth and decline of individual places is that of choosing the variable(s) by which change over time is to be measured. Several types of variable are possible, but it is argued that the selection should be made according to the characteristics of the urban system under examination. For a system whose individual elements are nodes functioning primarily as trade centres, the most meaningful data from which change could be established would include measures of retail and service business (the "currency" in which the system operates) and numbers and types of central functions. Irrespective of the characteristics of the places under study, however, most researchers have chosen change in population size to index growth and decline--a selection which makes the implicit assumption that growth or decline in numbers of people provides a meaningful surrogate for change in other variables. "Yet, clearly, there may be relatively little correspondence, particularly at the micro-scale, between the spatial patterns of growth in employment, industrial output, population, gross incomes, per capita incomes, etc." (Moseley, 1973, p. 144). These different growth phenomena respond to different forces. If an explanation of the variable rates of population growth among the constituent places of an urban system is required, it would appear logical to adopt an approach whereby the contributions of fertility, mortality and migration are first established. This done, a second step in the analysis would be to reach back further in the causal chain by searching for explanations of the contribution of these demographic phenomena (see Arriaga, 1968; Stone, 1967; Zuiches, 1970). Variability of change in volumes of business carried out in the same set of places, however, could not be expected to be a function of the identical set of factors. Rather, as has been noted above, alterations in volume of business are due primarily to the operation of changes in demand or demand-related behaviour. To the extent that healthy trade centres attract new entrepreneurs, some correlation between population growth and trade growth is to be expected. But since the sets of forces to which the two types of growth respond overlap only slightly, it is dangerous to assume that one will act as a reliable surrogate for the other.

From a classical viewpoint, change in total trade volume is inferior to change in centrality as a measure of growth and decline. Christaller (1966) defined the status of a place as its centrality or surplus importance--a measure of its performance as a provider of goods and services in excess of the requirements of its own population. The centrality of a place therefore constitutes only that part of its total trade volume which derives from an external support population, and temporal variations in centrality would indicate variations in the degree of attraction exerted over the complementary area. Unfortunately, data by which centrality can be accurately measured are not always available (see, however, Preston, 1970; 1971), and to the writer's knowledge there have been no studies of growth and decline among central places in which change in centrality has constituted the dependent variable.

Growth and decline, of course, are not merely quantitative expressions, and they cannot always be fully summarized in simple numerical terms. At least two levels of abstraction at which growth may be considered are applicable to considerations of change in central place systems (see Boulding, 1953). The more basic of these is referred to as "simple" change, as occurs when the growth of an aggregate (such as dollar volume of trade) is achieved by the addition of further units (dollars) equivalent to those making up the original aggregate. Cross-sectional comparisons at different dates of retail trade or population size involve the conceptualization of growth or decline only at this "simple" level. "Structural" growth, on the other hand, occurs when new units are added which differ in substance from those previously present. Such growth involves change in the form of the aggregate, as occurs when a growing town achieves new trade thresholds at which new (and higher-order) businesses may be attracted.

The benefits of using both conceptualizations of the nature of change appear to have escaped researchers in the field of central place dynamics. Most studies, by examining changes in population, trade or numbers of functions, contribute to an understanding of system reorganization at only the "simple" level of abstraction; of the works listed in footnote 1, only Stabler's (1973) has considered change in terms of types of activities being added to and removed from the functional structures of central places.

The Treatment of Process

Surprisingly few studies of change in central place systems have approached the problem using a process framework (see, however, Morrill, 1963; 1965). Much more common has been the adoption of Pred's (1965) "initial advantage" formulation, which proceeds from the selection of "explanatory" variables hypothesized to bear a causal relation to the dependent variable. Briefly stated, the concept makes explicit the notion that at any one time, the places in a system have in varying degrees the likelihood of future growth. In a central place system, for example, it might be hypothesized that in the competitive process of attracting trade, some centres are at an advantage (by virtue of range of functions offered, accessibility, and location relative to other places) and will grow, while others lacking these benefits may undergo relative or absolute decline.

The concept of initial advantage has considerable generality and may be applied to a variety of types of system. Thompson (1965), for example, has used it in generating a hierarchical system of industrial places analogous to the hierarchy of service centres. For urban systems in general, technological advances in transportation and production have, in an historical context, bestowed advantages on a few centres rather than all. Transport improvements have enlarged market and supply radii (Beckmann, 1970; Hoover, 1972) so that firms previously not engaged in spatial competition have been brought into competition with each other (Berry, 1959, p. 342). When this occurs the locationally more efficient firms (those which can deliver at a lower per-item cost) are enabled to usurp the market areas of their less efficient rivals, who may drop out since the area can now be served with a product from a smaller number of points than was previously the case. Similarly, developments in production techniques have tended to reduce the number of firms required to satisfy demand for a good. Increasing capitalization of industry (as of agriculture and tertiary activities) has heightened the importance of scale economies, which again means that the efficient production of an item will occur from a smaller number of production points (Hoover, 1948; Isard, 1956; Neutze, 1967; Nordström, 1971). The disappearance during the present century of a number of traditional small-town and village industrial activities testifies to the fact that these places were disadvantaged by changes in production and transportation technologies.

In studies of the growth and decline of central places, correlation and regression analyses based on the logic of initial advantage have tended to produce disappointingly low coefficients of determination (see, for example, Brozowski, et al., 1973; King, 1964; and Tarver and Beale, 1968). In part, no doubt, this is the result of unavoidable difficulties associated with the use of imperfect data to test theoretical concepts, together with the fact that "pure" central place systems do not exist in reality. But some responsibility must be accorded the concept itself. The notion of initial advantage, while providing a potentially useful means of predicting variations in the propensity of places to grow, does not easily permit an elaboration of the role of process in growth differentiation. Because the state of the system is held to be the sole determinant of its state at some time in the future, changes in state which occur between the two control dates cannot be subsumed in the analysis. Yet on-going processes (and sudden, once-and-for-all events such as the establishment of a new retail outlet) are constantly producing stresses to which the places in the system are adjusting. Even when the initial advantage concept is abandoned and independent variables are expressed in terms of change over time, we cannot be certain that the expression accurately describes the actual time-path taken by change. The process of rural depopulation, for example, may be represented as the percentage fall in a population between specified dates. Yet depopulation results from a number of individual decisions and presumably occurs irregularly in the form of discrete events in which individuals or families move away from farms. Even if the process were continuous and unchanging in intensity over time, reactions to it in the central place system (for example, the closure of stores) would still be instantaneous once the relevant decisions were taken by entrepreneurs. To accommodate these problems of measuring and explaining change it becomes necessary for the researcher to pursue a strategy whereby all relevant process-related events are recorded as they occur (Wilkie, 1968, p. 19). Unfortunately for much historically-oriented research, such an approach must be ruled out on logistical grounds since long periods of time may be required for processes to manifest themselves in the system. Instead it is necessary for students to utilize data, such as those in census reports, which are discrete, cross-sectional observations (Harvey, 1967, p. 555).

Because of their clumsiness as vehicles for the examination of process, the initial advantage concept and the method of comparative statics have their deficiencies in handling the form of change. Not all relations between hypothesized causes and effects have the same "temporal texture"; some processes take longer than others to create alterations to the central place systems on which they operate. One of the dimensions of change to which geographers have paid little attention (see, however, Gauthier, 1968; Haggett, 1971; King, Casetti and Jeffery, 1969) relates to the existence of variable lead-lag relations between cause and effect.

Consider a simple example in which competition between towns for trade is seen as taking place via the transmission of impulses. The entry of a new function into an established central place system alters the competitive structure of the system, and the previously-existing functions are forced to adjust. If the new function is more attractive or more efficient than the existing ones with which it now competes (as in the case of a large supermarket entering a system in which food was formerly retailed through small grocery stores), some of the support of the latter is likely to be usurped. An impulse has been transmitted from the supermarket to the grocery stores via the changed spatial behaviour of consumers. The grocers, of course, may resist the new competitive pressure by instituting internal economies or by extending credit to their customers (Anderson, 1967, pp. 159-60). Should these measures fail to bring relief, some groceries may be forced to close, causing a further alteration in the locational pattern of points at which consumer demand for foodstuffs may be satisfied. In this hypothetical case the collapse of the grocery stores need not (and in fact in the real world will not) occur simultaneously with the establishment of the supermarket. Rather, there is likely to be a lag between cause and effect. Cross-sectional studies of change between only two control dates thus ignore the existence of an important quality of change in spatial systems. At best such studies have done little more than select dates sufficiently far-apart in time to allow the response lags associated with the process of reorganization to run their course. Lag times themselves have remained unmeasured.

Because of the differing time scales over which processes operate in creating change, care must be exercised if concordance between time scale and process is to be achieved. The hypotheses forwarded in studies of growth and decline among central places imply that researchers have been oriented toward a search for fundamental underlying forces which operate over long periods rather than for explanations of short-term variations in the size of places. Yet these same students have tended to apply their hypotheses to relatively short periods of time--in several cases of less than ten years (see, for example, Johnston, 1969a; 1969b; Scott, 1968). Over such periods much change may derive from "lightning strikes" (Borchert, 1963, p. 38) which may be nothing more than local or transient occurrences constituting random disturbances and obscuring a general trend (Fuchs, 1959, p. 2). Golant (1972, p. 129) found that higher coefficients of determination in the explanation of growth differentials were found for long periods than for short, "perhaps an indication of the lag between changes in the rates of growth and substantial adjustment in urban structural character. Analyses based on five-year periods [were] inconclusive, partly because of this lag effect and the tendency for short-run growth rates, particularly for smaller centres, to be highly unstable."

Findings of the Empirical Literature

Given the deficiencies of empirical research to date, both as regards its modes of conceptualizing change and its treatment of process, it is not surprising that firm conclusions on structural change in central place systems have not been reached. Indeed, for some time researchers were unable to agree even on the basic question as to whether small trade centres were in general growing, declining or disappearing (compare Ferriss, 1950; Lively, 1931; Marshall, 1946; Smith, 1942; and Trewartha, 1943). Greater discrimination in the use of data and a heightened sophistication of technique have, fortunately, improved our understanding of the patterns and to some extent the processes of reorganization. In this section an attempt is made to summarize the findings which have contributed to that understanding. It must be borne in mind, however, that most of the studies under review have concerned themselves with inter-place differentials in population change rather than with differentials in centrality or trade trends. But given the existence of at least reasonably strong correlations between these different measures of change, it seems safe to assume a general correspondence between the patterns of reorganization that they identify. In the following summary each of the variables employed in past attempts to explain growth differentials is labelled as either a demand- or a supply-side force; this is the method by which Christaller (1966, pp. 84-132) conceptualized the agents of change.

Initial size.--Probably the variable which has been used more than any other in attempts to explain differentials in growth rates is the size of places at the beginning of the period under consideration (Brunner and Smith, 1944; Hautamaki, 1967; Johnston, 1967; 1969a; King, 1964; Nelson and Jacobson, 1941; Northam, 1963; Ratcliffe, 1942; Scott, 1968; Tarver and Beale, 1968). Size of population may be used as a surrogate for more general notions of the status of places (Hodge, 1965b, p. 106; Hodgson, 1972, p. 140) but in a central place context it can be taken as indicating the range of goods and services supplied and consequently the attractiveness of places to surrounding populations. Initial size is thus a summary of the supply attributes of central places. The hypothesis that initial size and rate of growth are positively related has a firm basis in theory: new activities tend to be attracted to larger places, where they are closest to their markets and can best obtain internal economies of scale and the economies attendant upon agglomeration. Particularly because of the economies of agglomeration, larger places also tend to constitute least-risk locations for entrepreneurs operating under real-world conditions of uncertainty (Webber, 1972, p. 205).

While correlation and regression analyses have generally validated the size-growth hypothesis as regards the direction of the relationship, the coefficients summarizing the degree of relationship have in most cases been low (see, for example, King, 1964, p. 37; Tarver and Beale, 1968, p. 22). Less sensitive contingency table descriptions, in which places are grouped by size, tend to show the relationship more clearly (Johnston, 1967, p. 216). At the elemental level of the individual place, it appears, initial size is not an accurate predictor of future growth performance as far as population change is concerned. In those few cases in which change in numbers of functions has formed the dependent variable, a somewhat firmer generalization is possible. The pattern here is that the larger places tend to show the greatest growth while centres lower in the hierarchy are the most prone to loss of functions or demise (Barber, 1971; Davies, 1970; Hodge, 1965b; Stabler, 1973). Again, however, the growth behaviour of small places is erratic. While many are in decline, the term "upward stagnation" (Hart and Salisbury, 1965, p. 158) may in some areas be a more appropriate description of the class as a whole. In any case Hodge's suggestion (pp. 96-97) that central place hierarchies are becoming polarized between the highest and lowest levels, with a decline in the number of places occupying the middle ranks, appears to be valid.

Relative location.--The influence of location on the growth rates of central places has been considered by several researchers, most of whom have examined the growth behaviour of places in terms of their locations relative to major cities. Varying conclusions have been reached, largely as a result of variability in the characteristics of the systems under examination. In relatively "pure" central place systems it appears that major centres exert a debilitating effect on their smaller neighbours, the effect decreasing with distance from the major cities themselves (Hodge, 1965b; 1966a; Nelson and Jacobson, 1941; Thakur, 1972, p. 60). Such a pattern suggests that in a situation in which central places compete for custom, the large cities tend increasingly to dominate their neighbours and usurp their trading function (Berry, 1960; Isard and Whitney, 1949). Relative location therefore has a bearing on the disposition of demand: small centres distant from large ones are shielded from penetration of their market areas so that the distance-growth relationship is positive. Many large and growing cities, however, are undergoing a decentralization of their residential functions (Schnore, 1957); in these cases small central places nearby have grown rapidly in population as a result of becoming commuter satellites. A U-shaped association between population growth and distance is apparent under these conditions (Borchert, 1963; Harden, 1960;

Hassinger, 1957a), with places close to and distant from the city growing more rapidly than places of intermediate location. It is doubtful, however, whether the same relationship would hold if growth were measured in terms of centrality or volume of trade. Many small towns located near large cities are growing in population but are apparently losing their roles as foci for shopping trips from surrounding rural areas (Borchert and Adams, 1963, p. 20; Lamont and Proudfoot, 1972, p. 9; Mark and Schwirian, 1967, p. 32; see also Hutton, 1965, pp. 100-01). Similarly, much trade is lost through outshopping by local residents; while this phenomenon is increasingly common to small centres in general, it is those situated in close proximity to major cities which are most affected (Lillis and Hawkins, 1974). The apparent conflict between the two types of pattern identified is thus resolved when the influence of commuting is taken into account. Close to major cities a competitive spatial pattern of growth and decline is evident when change is measured in terms of trade and service activity; this pattern is often obscured when population change is employed as the dependent variable (Barber, 1971, p. 67; Butler and Fuguitt, 1970, p. 407).

A few students have also considered the growth-distance relationships which obtain among non-metropolitan places themselves. For Ontario, Hodgson (1972) discerned the existence of a contagious rather than a competitive growth pattern, but such a finding would be expected on the basis of growth pole theory (Nichols, 1969) in an area in which central place economies are being modified by the development of many linked industries. The Ontario pattern is strongly reminiscent of Burton's (1963) concept of the "dispersed city" (such "cities" often develop in linear patterns along corridors of growth: see Haake, 1972;

Russwurm, 1970). Although the potential applicability of the dispersed city concept to rural central places was anticipated by Smith (1940, p. 496) and has occasionally been reiterated since (see, for example, Doerflinger and Marshall, 1960, p. 29), it does not appear that such places are generally able to reach accommodation with one another to assure their continued survival (Kenward, 1972). Rather, the dominant mode of interaction between them is competitive. Such competition between places appears to work toward the weeding out from the system of those places which are situated in unusually close proximity to more viable neighbours (Hodge, 1965b, pp. 100-01). The effect of the demise of these places has been a reduction in the variability of inter-place spacing (Hodge and Paris, 1967, p. 17) as the distribution of central places becomes more regular (Kariel, 1970).

The generalization which emerges from discussions of the location-growth relationship in central place systems is that growth is most likely to be greatest in those places which are situated at maximum distances from their rivals. If this generalization is valid, it is possible to place an evolutionary interpretation on the distributive pattern of central places as illustrated in the familiar K = 3 model of Christaller. In this model, the epicentre of an equilateral triangle described by the locations of three first-order centres (A_1, A_2, A_3) is occupied by a second-order place (B) which in turn is surrounded by six third-order centres (C_1 - C_6). Each of the latter places is only half as far from an A-centre as is B. If it is assumed that all places originated at the same time and were initially differentiated only by location, it becomes apparent that the B-centre had occupied a more advantageous site than the surrounding C-centres in terms of situation relative to the larger A-places. The principle inherent in this argument was elucidated by Lukermann (1966), who noted that the system itself controls the entry of new centres and the growth rates of those already existing: the system " . . . pulls in the towns that fit. It adopts from a population of potential aspirants those that have a situational advantage, given the system" (p. 43). Skinner (1965) showed for rural China that the development of new villages tended to occur at maximum distances from existing places, while Godlund (1951) reached a similar conclusion from an examination of urban growth in southern Sweden. In this area he found that new centres of a particular order showed a tendency to develop approximately mid-way between existing centres of the same order, while places closer to the original centres showed a lesser propensity to grow. Evidence from the relatively pure central place systems of the North American Great Plains supports the notion that the system itself "selects" certain places to grow, and that the distance factor is a key element in the process of selection. Large tracts of the plains were settled within short periods during the homesteading era, and scores of elemental central places were created almost simultaneously. Few were selected to grow beyond hamlet status, however. Any central place system has only a certain capacity to support high-order centres, and an oft-repeated pattern was for one member of a group of hamlets to surpass its neighbours and attain a position of higher order. Such growing places tended to be relatively distant from previously existing higher-order places (see, for example, Jensen, 1972, pp. 38-41). With the process being repeated over time certain centres grow out of the low-order class; the process is then repeated again at higher orders and a hierarchy is gradually created where none previously existed (Marshall, 1964, p. 123).

Change in tributary area population.--Alteration in levels of support given by the surrounding trade area, a demand-related factor, provides a further influence on the growth performance of central places. This variable, however, has been given little explicit treatment in the literature, in part because of the difficulty of meaningfully determining the boundaries of trade areas--particularly when these boundaries change over time. Higgs (1969) has demonstrated the existence of a direct relationship between growth of population density in rural areas and growth of central places. Ceteris paribus rural depopulation would result in the decline of service centres, but in reality this effect is usually overcome by the larger centres which have been able to enlarge and penetrate more fully their trade areas and thereby maintain or increase their support populations. Small centres providing only day-to-day needs have, however, declined as a consequence of the loss of their support population (Fuguitt, 1965b; Hodge, 1965a; pp. 29-36).

Income and social change.--The general rise in living standards during the present century (a characteristic of demand) has seen an "urbanization" of the habits and desires of rural and small-town populations (Lampard, 1965, p. 519) and is basic to an understanding of changing consumer behaviour in central place systems. Differences between social groups persist in rural areas, however, and since different groups use the hierarchy of central places in varying ways it can be said that in effect each group has its own system (see Murdie, 1965). The higher status and higher income groups, traditionally the most mobile, tend to trade more heavily in large centres than do groups of lower status. Accordingly the survival of small central places is to a degree dependent on the continued presence of low-income consumers; by extension, spatial variability in the trend for real incomes to rise will create spatial variations in the propensity of such places to survive. In the American South, hamlets and villages are generally in decline as a result of the advent of larger-scale, more mechanized farming which has increased per capita incomes and favoured an increasing concentration of shopping trips on larger central places (Barber, 1971, pp. 90-91).

Functional mix.--Some research has been carried out to ascertain whether a relationship exists, independently of size of place, between the types of function present in service centres (a supply characteristic) and their growth performances. Stabler (1973), for example, has suggested that declining centres might be expected to show heavy concentrations at the beginning of a study period of functions which themselves were unusually prone to drop out of the system. His hypothesis was not supported, however, and it was concluded that functional structure was not a fundamental determinant of change. Presumably the declining trade centres under consideration in this example were not ill-fitted to service a tributary population by virtue of an overconcentration on outmoded types of activity. In similar vein it has often been surmised that the presence of a county seat in a central place might be a "critical function" in generating growth or in providing a hedge against decline (Fuguitt, 1965c; Tarver and Beale, 1968). Again the hypothesis has received little support, in this case because the influence of the county seat variable was almost completely subsumed by the variable labelled initial size. In the same context Hodge (1968) has suggested that the decline of small towns on the Canadian prairies will not be an inevitable concomitant of the loss of grain shipment functions. While the establishment or loss of a function may institute a multiplier effect for future change, there appears to be little evidence that particular types of activity are more important than others. If specific critical or symbolic functions do exist in central places, they have apparently yet to be discovered. More important to a centre's growth prospects may be the quality of service rendered by its central establishments.

Characteristics of the roading system.--The location and quality of road links in rural areas also appear--by virtue of their influence on the travel behaviour of consumers--to have played a role in creating disparate rates of growth among central places. Marshall (1964, p. 30) notes that in the Bruce and Grey counties of Ontario almost all the central places which ceased to function during the present century were located off the major highways. This finding appears to be rather general: Hobbs and Campbell (1967) report that for Missouri between 1950 and 1960, places on major paved highways were more likely to grow in population than were those on lesser roads. When size of place was held constant the conclusion was not altered (p. 7). The impact of improvements to the surface quality of highways and rural roads has been given less attention, but again the available evidence suggests that such improvements operate to create differentials in growth. A study conducted in rural Kentucky by Stroup and Vargha (1963) indicates that isolated stores are prone to close within a few years of the paving of an adjacent road, while agglomerations of three or more establishments are less sensitive to change. Where shops in the latter centres were abandoned, closure took place after a much longer lag following the date of paving. Still larger centres tended to grow vigorously in numbers of functions, since the upgrading of highways linking them with their trade areas increased their accessibility to rural patrons. Once more a competitive pattern, in which the larger centres grow at the expense of the smaller, is evident.

Places recently removed from on-highway locations by the construction of local bypasses have been the subject of considerable research, particularly in the United States (see United States Department of Transportation, 1972, pp. 11, 43-86). In most cases these communities did not experience the anticipated strongly-negative effects of being bypassed. Businesses oriented toward transient traffic tended to suffer reductions in sales in many cases (Buffington, 1967; Garrison, 1959), but even these operations were found to have depended on local, resident trade to a greater extent than had previously been thought. Activities not oriented toward transient custom tended to retain their existing local trade (Erion and Mitchell, 1966; Jorgenson, 1968); in some cases such trade has been stimulated by the alleviation of traffic congestion on the main streets of bypassed towns (Berry, 1960, p. 116). Overall, towns which have been removed from major highways have continued to experience growth in retail sales (United States Department of Transportation, 1972, p. 11).

Evaluation

An attempt has been made both to review the existing empirical literature relating to the growth performance of places in central place systems and to summarize its findings. The latter are somewhat diffuse, no doubt in part because the processes active in producing spatial reorganization are complex and render firm conclusions regarding the trajectory of change difficult to draw. But some of the confusion about reorganization derives from deficiencies in the literature itself as regards (a) the specification of dependent and independent variables, (b) the conceptualization of relevant processes, and (c) the apparent lack of concordance between timespan and hypothesis. Particularly in the literature of geography and rural sociology there has been a tendency for case study to duplicate case study, with a consequent retesting of previously-advanced hypotheses on data already found wanting. Recent developments, however, suggest that more penetrative analyses of the forms of change in central place systems are possible. Alongside conventional "timeless" location theory is emerging a new body of spatial reorganization theory which is attentive to on-going processes that work toward the progressive alteration of spatial arrangements. Part of this thesis represents an empirical investigation cast within the mould of the theory of spatial reorganization. After first replicating selected aspects of the research discussed above (albeit using data not previously applied to the problem of growth and decline among trade centres), it follows a process-oriented strategy in an attempt to explain the form of reorganization taken by a system of central places in the Red Deer (Alberta) region between 1941 and 1971. The particular processes considered are those which, over time, alter the spatial foci of consumer's demand-satisfying behaviour in rural areas. Such processes are frequently alluded to--but rarely examined in detail--in the literature. No suggestion is made here that alterations to patterns of consumer mobility represent the only or necessarily the most important inputs to reorganization. Other determinants also require consideration, but in

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the interests of depth in the treatment of the role of mobility these are given only cursory attention.

CONSUMER MOBILITY AND CENTRAL PLACES

Hitherto, the relations between consumer mobility and central place dynamics have been accorded little explicit attention by researchers, although references to the importance of mobility are numerous (see, for example, Fuguitt, 1963, pp. 248-51; Hodge, 1965b, p. 99; Marshall, 1964, p. 131; Moline, 1971; Rushton et al., 1967, p. 389; Ruth, 1972; Smith, 1972, pp. 30-38; Thiel, 1962; Wibberley, 1960, pp. 121-24). Those who have attempted to conceptualize the processes underlying the reorganization of central place systems are in no doubt regarding the importance of alterations in the patterns of consumer movements. Curry (1967, p. 219) has stated explicitly that the spatial and hierarchical structure of central place systems is the result of consumer (and entrepreneurial) behaviour past and present and the differences between them. Fox (1962, p. 17) comments in similar vein, while also recognizing the importance of increasing scale of operation of central establishments as a source of change: "A basic problem of rural America is that of adapting its nineteenth century economic and political pattern to the shopping, cultural and public service requirements of larger firms and more mobile consumers. . . . The pressures for change operate in the direction of a reconciliation of the discrepancy between [the region's] actual economy and its 'optimal economy'" (p. 15; see also Clawson, 1966; Munger, 1966, pp. 15-16).

Despite the apparently general recognition of the importance of changes in consumer movement behaviour, however, little attempt has yet been made to measure the extent to which mobility has increased or to explore the forces lying behind that increase. Information on past mobility states is, of course, fragmentary, and while some conclusions can be drawn on the degree of increase in mobility from cross-sectional studies whose reference point is a single moment in time (see Murdie, 1965), a retrospective research strategy is necessary if a fuller illumination is to be achieved of the processes by which increased mobility occurs. But here the problem arises that a long period of time is often required for increases in consumer mobility to manifest themselves in alterations to the system, particularly when there may be response lags on the part of entrepreneurs in the central places (Stroup and Vargha, 1963). It thus becomes virtually impossible to pursue the optimal research strategy of observing the processes as they occur (Wilkie, 1968, p. 19) or of reconstructing them as soon as possible thereafter (Brown and Holmes, 1971). Instead the researcher must construct hypotheses about the forces which logically can be expected to produce behaviour-altering responses from individuals, and to attribute to the latter the characteristics of "rational man." The conceptual deficiencies of such an assumption have been made apparent both by the behaviourists within the discipline (see, for example, Cox, 1974; Golledge, 1970; 1973; Wolpert, 1965) and by those who have attempted to disaggregate the patterns of consumer movement (Huff, 1961; Kohls, 1959; Ray, 1967). But provided (a) that the processes which act to produce alterations in movement behaviour are sufficiently fundamental that at least the direction of alteration does not vary, and (b) that the consumers constitute a near-homogenous group amongst whom variations in responses are insignificant, the practical import of these deficiencies is minimized. On the latter point it has been suggested (Berry, 1967, pp. 87-88; Clark and Rushton, 1970, p. 496) that consumer behaviour in rural areas and in small towns is less variable and less complex than that which occurs in cities. Almost by definition, the latter represent the most cosmopolitan settlement units in western societies.

Mobility and Time-Space Convergence

Numerous forces have contributed during the present century to the increased spatial mobility of consumers. Rising incomes and living standards and the increasingly pervasive influence of the mass media have created a massive growth in demand for goods and services, particularly for those supplied from the larger centres. In addition, by utilizing their control over the media, the major cities have deepened their impact on buyer tastes and wants over increasingly large areas. Within these areas, in the small towns and in the countryside, consumers have experienced a greater and greater "felt need" for mobility, and that need has been translated into new spatial patterns of movement by improvements to the means of vehicular transportation and to the quality of route networks. Consumers have been enabled to travel ever-greater distances per unit of time expended; central places have, in effect, "converged" on one another in time-space as the frictions of distance have weakened.

The increased mobility of consumers within central place systems is, of course, only a single indicator of the shrinkage of time- and cost-space within spatial systems in general. Indeed it might be said that the progressive reduction of the frictions of distance over the past two centuries constitutes one of the great forces in human history, although the theme has received little more attention from historians than from geographers (see, however, Blainey, 1966; Malin, 1944). The increasing ease and speed of movement and communication between points has vastly enlarged the action spaces of individuals in advanced nations and altered the economic bases of regions. More people are travelling greater distances than ever before, and the spatial extents of human contact fields have been widened by increases in migration distances (Gallaway and Vedder, 1971; Ogden, 1973, pp. 24-43) and in the distances covered by circulatory movements such as recreational and commuting journeys (Abler et al., 1971, pp. 552-53; Evans, 1969, pp. 89-90; Healy, 1947, pp. 81-82; Zelinski, 1971, pp. 245-47). Ideas and innovations are being diffused through space at increasing rates (see, for examples pertaining to different periods within the human time span, Abler, 1971; Edmondson, 1961; and Pred, 1973), while areal specialization in production has been made possible by the increasing ease of trade between regions (Ullman, 1956). In addition, improvements to transport networks have contributed to the general expansion of the market potentials of major cities (Olsen and Westley, 1974). But even in the advanced, highly developed countries not all regions have shared equally in the trend for points to be brought closer together in time- and cost-space. Some peripheral areas, not fully connected to the new transportation networks, have in a relative sense become even more isolated and remote from the regions of growth than previously (Hall, 1966).

The concept of time-space convergence has been given operational status in geography by Janelle (1966; 1968; 1969; 1973; 1974); who has sought to use it as an explicand of reorganization within space-economies. Briefly stated, the convergence of points in space takes place as the time taken to traverse the distance between them is reduced. The extent of the reduction over a period may be expressed as a rate: for example, minutes saved per year on a specified journey between places (1969, pp. 359-60). For thirteen metropolitan areas in the Upper Midwest, Janelle found a positive relationship between growth in wholesaling activity and the degree to which places had experienced time-space convergence on their rivals. Those places which had improved their transport links with other centres in the system to the greatest degree tended to show the greatest growth in wholesaling activity, regardless of whether the latter was measured in terms of sales volume, numbers of establishments or numbers of employees (pp. 362-63). In other words, the metropolitan areas whose radiating routes had been improved most had increased their accessibility to the greatest extent, and therefore their locational utility to entrepreneurs as distributive points. Degree of time-space convergence appeared to be moderately successful in predicting the extent of growth in wholesaling activity for individual places (pp. 363-64).

Janelle's success in operationalizing the convergence concept and in illustrating its ability to explain observed patterns of growth in wholesaling activity suggest that it may be applicable in other situations. One might surmise, for example, that the concept should be capable of adding to our understanding of spatial reorganization in central place systems. Since all routeways within a region are not upgraded at the same time or to the same extent, differentials between places occur in terms of their degrees of convergence upon one another in time-space. Accordingly, differentials in the relative accessibilities of places are created, and the utilities of the places to consumers are altered.[2] It follows that if shoppers respond to the changed utilities of central places by altering their movement behaviours, then volumes of trade carried on in those places will also be altered. These notions have been co-ordinated by Smith (1972, p. 40) in the form of a simple model, a slightly expanded version of which is presented in Figure 1.

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[2] The locational utility of a place to a consumer may be defined as its perceived value as a node for obtaining goods and services, given

In central place systems serving rural areas, the tendency for consumers to travel increasing distances in order to satisfy their demands for goods and services appears in large measure to have been a function of the reduction in the time and convenience costs of movement. Three forces, acting in concert but not in a strictly contemporaneous fashion, have contributed to this effect: improvements to motor vehicles, the diffusion of vehicle ownership through society, and the upgrading of the road transport network. The basic technology of the automobile was a creation of the pre-1945 period; improvements since World War II have taken the form of refinements rather than radical innovations (Rae, 1965, p. 179; White, 1971, p. 211). Nevertheless these refinements (including increases in engine horsepower, more streamlined physical design, strengthened tires and the development of higher-octane gasolines) have allowed a general improvement in the capacity of vehicles to reach and maintain high speeds. For most of North America, highway upgrading has reached its peak only since World War II with the paving of many rural roads and the widespread adoption of the divided freeway as a means of connecting major cities. Levels of vehicle ownership have shown, with the exceptions of the depression of the 1930s and a brief period during the Second World War, a prolonged tendency to increase as real incomes

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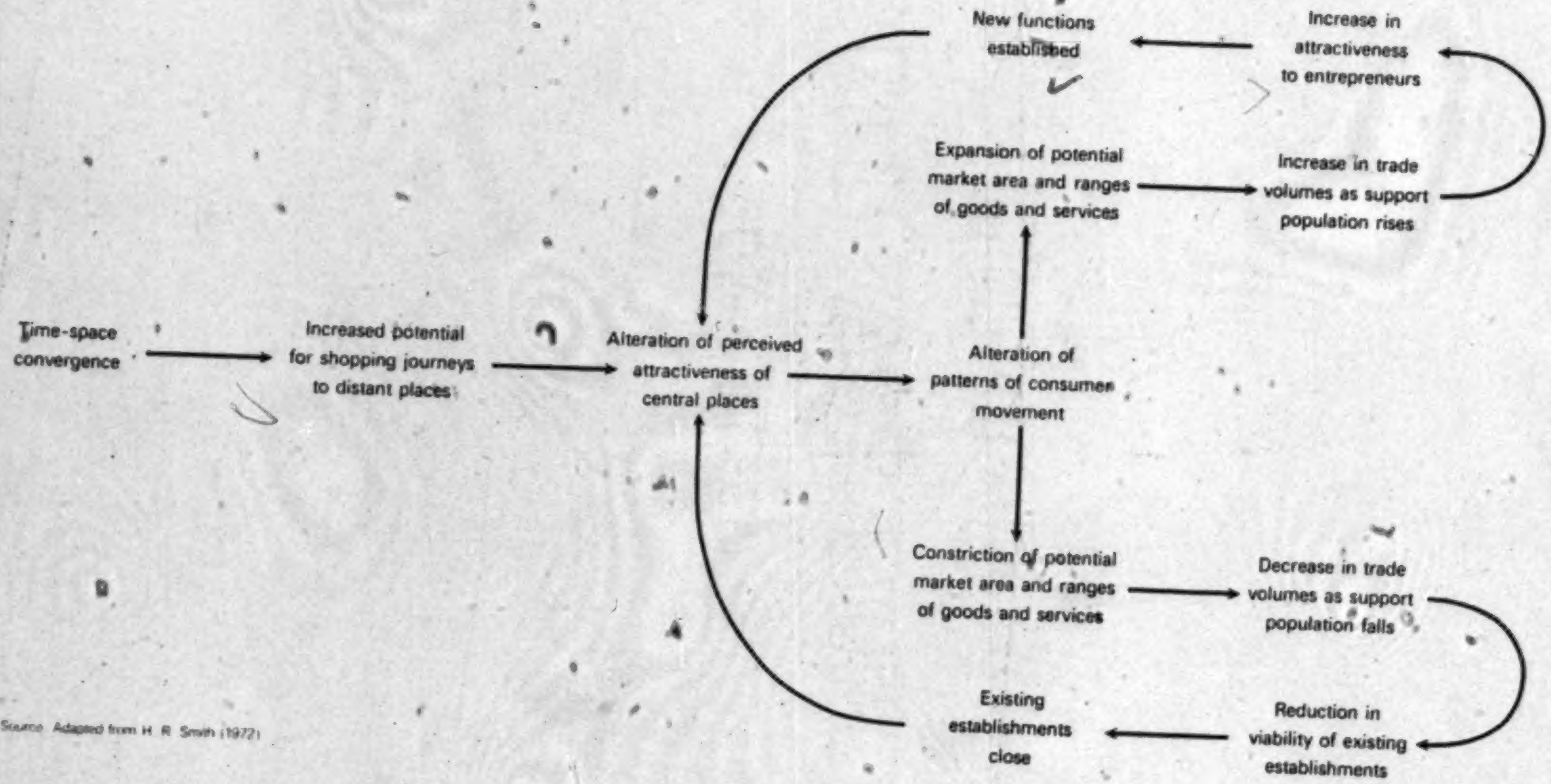
the costs and satisfactions pertaining to shopping trips to that centre.


Time-space convergence
Increased potential for shopping journeys to distant places
Alteration of perceived attractiveness of central places
Alteration of patterns of consumer movement
New functions established
Increase in attractiveness to entrepreneurs
Expansion of potential market area and ranges of goods and services
Increase in trade volumes as support population rises
Constriction of potential market area and ranges of goods and services
Decrease in trade volumes as support population falls
Existing establishments close
Reduction in viability of existing establishments

Source: Adapted from H. R. Smith (1972)

Figure 1 THE IMPACT OF TIME-SPACE CONVERGENCE ON CENTRAL PLACES

have risen (see Horvath, 1974, p. 176).

The effect of these developments has been to reduce the frictions of distance and thereby to bring central places closer together in time-space. Since consumers are enabled to travel greater distances in order to obtain goods and services, the potential trade areas of service centres have been expanded. But in actuality, unless large areas remained unserved before the institution of improvements to transportation facilities, this outcome cannot occur for all trade centres. Many places, once protected from incursions of their trade areas by neighbouring competitors, have lost the insurance that primitive transportation formerly gave them. In travelling greater distances to shop, people now bypass the centres they and their forbears previously patronized (Murdie, 1965; Rushton, 1969). Intervening opportunities for the purchase of goods and services are thus being ignored as part of the tendency toward multi-purpose shopping trips to larger centres in which greater numbers of requirements can be satisfied (see Thompson, 1971; Yuill, 1967). Such bypassing has been observed to be characteristic of centres at all but the highest levels of particular regional hierarchies (see, for example, Stabler, 1973, p. 28), but it is presumably the smallest trade centres which suffer to the greatest extent. Such places offer only a limited range of goods and services and hence only slight opportunities for consumers to satisfy several requirements on a single journey; losing trade, many of the establishments in small centres are eventually forced to close. Meanwhile larger centres benefit from the new mobility regime, and draw custom from further afield. New trading thresholds are achieved, more functions are attracted and a cumulative growth pattern is instituted (Smith, 1972). Both the distributional and hierarchical characteristics of the system are thus altered as it undergoes transformation in the direction of the optima of the new spatial order. The dense patterning of the pre-automobile era is progressively transformed into a less dense one made up of fewer, but larger, distributing nodes.

The Canadian Prairies

Several observers of the Canadian prairie scene have commented that the close pattern of trade centres created during the late nineteenth and early twentieth centuries has been rendered obsolete by the increasing ease of movement in rural areas (see Hodge, 1965a; Jankunis, 1972; Munger, 1966; Pickersgill, 1961; Proudfoot, 1972; Qu'Appelle Basin Study Board, 1970; Zimmerman and Moneo, 1970; 1971). Until the depression the diffusion of car ownership through prairie society was rapid, and can certainly be said to have proceeded at a faster rate than did upgrading and extension of the highway network. The combined disaster of drought and depression, however, halted and reversed the process. Cars were converted to "Bennett buggies," and for many rural dwellers levels of personal mobility returned to those of horse and cart days. Retail sales in local trade centres fell heavily and a relative swing back to mail-order buying occurred (Britnell, 1939, pp. 27-28; see also Rumball, 1973, pp. 37-38). Recovery in levels of car ownership was at first slow: the return in the late 1930s of high wheat yields and favourable markets was quickly followed by war and a consequent postponement of prosperity. But after World War II cars and trucks returned to the rural scene, and in unprecedented numbers (Tyler, 1966, p. 284). Even in 1945 an automobile was considered a necessity, and certainly in the more productive agricultural areas most families owned a car, a truck or both (Burnet, 1951, p. 25). For those that did not, bus and train transportation were available, but given the level of community co-operation that prevailed, it is likely that those without personal automotive transport were able to share shopping journeys with more prosperous friends and relatives. This being the case, it may be argued that post-war increases in vehicle ownership, while increasing the levels of personal convenience associated with rural travel, have not greatly affected the potential of rural families to reach distant trade centres. Most important to the reduction of the frictions of distance in this regard have been the greatly expanded programmes of routeway upgrading--financed largely by royalties from the oil boom (see Hanson, 1958, p. 279)--carried out by provincial governments. No longer are the shopping trips of rural dwellers concentrated within the summer months, as was the case when the majority of country roads were made of earth. Since 1941 the mileage under bituminous paving or gravel has increased dramatically on rural routes in the prairie provinces (Table 1). With surfacing greatly improved, reductions in

TABLE 1

MILEAGE UNDER BITUMINOUS AND GRAVEL SURFACING ON HIGHWAYS AND RURAL ROADS, PRAIRIE PROVINCES, 1941-1968

Year	Bituminous Surface	Gravel Surface
1941	1,256	15,811
1951	2,677	40,839
1961	9,645	106,498
1968	16,478	144,047

Sources: Dominion Bureau of Statistics: *Canada Year Book 1942*, Ottawa, 1944, p. 606.
Dominion Bureau of Statistics: *Canada Year Book 1952-53*, Ottawa, 1953, p. 766.
Dominion Bureau of Statistics: *Canada Year Book 1963-64*, Ottawa, 1964, p. 771.

travel times have been pronounced: interviews of farmers in the Ferintosh area of Alberta revealed that the time taken to travel to Camrose, twenty-three miles distant, had been "practically halved" in the two decades following 1945 (Anderson, 1967, p. 155). Shoppers have been enabled to travel greater distances per unit time, and in doing so now tend often to bypass centres previously patronized.

THE PROBLEM

This study investigates the forms of structural reorganization taken by the Red Deer central place system between the years 1941 and 1971. Part of the analysis is merely replicative of past research, although the use of post office revenues to measure growth and decline among service centres has been preferred to the more traditional choice of data relating to population size (see Chapter II). Not all of the variables discussed above (pp. 20-29) are examined, however. Information relating to change in tributary area populations is neither directly available nor capable of being accurately derived from censuses; this is the case also as regards income and social change within the area. The impacts on growth behaviour of size of place, relative location and quality of adjoining roads are, however, considered. Verification is also sought for the proposition that time-space convergence within a central place system operates to alter spatial behaviour and thereby creates the conditions for divergent growth trends among member places (see Figure 1). Not all the elements of this model, unfortunately, are equally amenable to measurement. For many areas, data are available

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Source: (Table 1 continued) Dominion Bureau of Statistics: 1970-71 Canada Year Book, Ottawa; 1971, p. 908.

from which the structural and growth characteristics of central places can be reconstructed for dates past, and it is possible to quantify to some degree the conditions governing the ease and costs of movement across space. The intermediate links in Smith's chains of causation must, however, be inferred. It is unlikely that accurate data on changes in movement patterns could be obtained over long periods, even using the method of interview survey (Stabler, 1973, pp. 24-25). Still more daunting a problem, at least at the macro-scale of an entire central place system) would be to reconstruct the specific reactions of entrepreneurs to the changing patterns of consumer movement. The focus, therefore, is on the inputs to increased mobility, and on their eventual impact as is seen in the ways in which the system is transformed. Broadly, it was expected at the outset that the system would exhibit strong tendencies of spatial concentration in trade such that the large centres would be growing at the expense of the small, and that this centralization would be traceable in part to increased possibilities for consumer mobility consequent on the convergence of central places in time-space.

It will be noted that the approach outlined will not of itself lead to the formulation of a dynamic theory of location, though it may contribute indirectly to such a formulation. Three requirements appear to be basic to the development of a dynamic, process-derived theory of central place locations. It must:

(a) Begin with the genesis of the settlement system,

(b) Tackle "the cardinal problem . . . [of] the simultaneous evolution of roads and centers" (Curry, 1969; p. 277), and

(c) Show how the mobile functions migrate from place to place in response to changes in the locational utility of central places.

None of these requirements is met by this research. First, it begins with the central place system as it was in 1941, more than half a century after the initiation of settlement and at a time when the transportation system was already well developed and the outlines of the present-day urban system were clearly apparent. Secondly, data are not available by which the movement of tertiary activities within the system can be traced. For these reasons it is felt that the present study is more accurately conceived of as an investigation in the field of spatial reorganization rather than as location theory.

The research, then, is concerned with the changes by which an established system of central places undergoes reorganization in its hierarchical and distributional characteristics over time. Its theoretical justification is that contemporary spatial organization, being a function of alterations to past organizational states, can best be explained by reference to the processes by which alterations are achieved. The study also has practical point. In the prairies, as elsewhere, the post-war period has been one of growing concern and debate over the future of the small rural service centre in an age of metropolitanization (Clark, 1972; Fuguitt, 1971; Hodge, 1966b; 1968; Thompson, 1972). Policy decisions which will undoubtedly arise from this concern should be based on as clear an understanding as possible of the mechanisms by which spatial reorganization takes place.

Organization

The thesis is organized as follows. Chapter II outlines the methodologies adopted, discusses the hypotheses on which the research is based and provides elaboration on the qualities of the data employed. Both Chapters III and IV are given over to the presentation of the results of the enquiry. In Chapter III the primary stress is on describing the forms of reorganization which have characterized the regional system as a whole. Here the changes in the distributional and hierarchical configurations of the system are discussed, and the relationships between order of place and functions performed are briefly outlined. Chapter IV considers the individual places as discrete units, and attempts to unravel their contribution to reorganization at the macro-level of the complete system. At this point an attempt is made to ascertain the factors associated with the incidence of growth and decline among central places: here the role of time-space convergence is given particular attention. The final chapter synthesizes the findings of the thesis and offers suggestions as to the directions which might profitably be taken in future research.

SUMMARY

This chapter has reviewed the literature pertaining to the problem of growth and decline among the member places of central place systems and attempted to identify its deficiencies. The latter, it was suggested, may be reduced by allying the traditional initial advantage approach with an active consideration of the processes underlying the differentiation of growth rates among central places. Among these processes it was noted that the spatial behaviour of consumers has been accorded little attention. Such behaviour, however, is of relevance particularly as a result of its propensity to change when the constraints upon it are eased. One powerful constraint on freedom of movement to service centres in the past was the low quality of the rural transportation network; in recent decades this restriction has to a considerable degree been overcome. In this thesis some of the traditional hypotheses relating to growth and decline are retested, but in addition an attempt is made to quantify the upgrading of the road network and to ascertain the impact of improvements to it on the central place system of the Red Deer region.

CHAPTER II

METHODOLOGY

The goal of this study is to seek explanation of the forms and degrees of structural reorganization undergone by systems of central places in the recent past. In the present chapter the criteria by which the particular system examined was chosen and its spatial bounds defined are presented, and the choice of time period is briefly discussed. Following is an outline of the form of reorganization that the system is expected to have taken during the period, together with a discussion of the methods employed to describe reorganization. Next the hypotheses, which are designed to test propositions relating to the growth performances of central places over time, are presented and given detailed elaboration. At various stages throughout the chapter some mention of the data to be utilized is unavoidable; detailed description and appraisal of these data are, however, delayed until after the hypotheses have been outlined.

STUDY AREA AND TIME PERIOD

Choice of Central Place System

The major consideration in the selection of an area in which to set the study was that it be a functional region comprising a dispersed rural population and a holistic system of nodes which operated primarily as central places. Most if not all of the settled portion of Alberta would have met these conditions, but for logistical reasons relating to the collection of data it was decided that the principal centre of the system should not be either Edmonton or Calgary, which in any case might have been ruled out on the grounds of the importance of non-tertiary activities in their economies. The centre selected, and the place which identifies and defines the system of nodes under examination, was Red Deer.

If the definition is accepted that central activities are those which function to provide goods and services to a surrounding territory, it appears that Red Deer's economy is more dependent on such activities than are the economies of Lethbridge and Medicine Hat, the other two Albertan cities which operate at the second level of the provincial urban hierarchy (for details of the structure of this hierarchy, see Tjorhelm, 1972, pp. 100-07). Unfortunately the labour force classification employed in the Canadian census precludes the precise estimation of the extent to which incorporated centres function as central places, since several categories enumerate workers in both central and non-central activities. The trade and service groups, however, may be regarded as being composed entirely of people engaged in central activities, and Red Deer has a higher proportion of its labour force involved in these two categories combined than either Lethbridge or Medicine Hat, though a lower proportion than in the smaller centres of Camrose, Lloydminster and Wetaskiwin. In the public administration-defence category, which is made up predominantly of workers in central activities, Red Deer ranks second only to Edmonton (the provincial capital) among the nine urban places in Alberta with populations of more than 5,000 in 1961 (see Table 2). Moreover, only Wetaskiwin of these nine centres had a smaller proportion of its labour force

TABLE 2

PERCENTAGE LABOUR FORCE COMPOSITION BY INDUSTRY, INCORPORATED PLACES OF MORE THAN 5,000 POPULATION, ALBERTA, 1961

Town or City	Number in Labour Force	Industrial Category								
		Primary Industries[a]	Manufac-turing	Const-ruction	Trans-port[b]	Trade, Services[c]	Finance[d]	Public Ad-ministration[e]	Not Stated	Total
Edmonton	131,576	3.3	13.3	9.5	11.1	44.7	4.1	11.6	2.4	100.0
Calgary	109,256	7.4	12.0	9.7	11.1	43.3	5.1	9.0	2.4	100.0
Lethbridge	13,454	4.1	11.4	7.9	11.7	50.9	4.1	7.7	2.2	100.0
Medicine Hat	8,548	5.2	19.3	8.3	12.2	42.0	3.2	7.3	2.5	100.0
Red Deer	7,124	4.5	7.2	9.8	8.8	52.5	4.0	10.6	2.6	100.0
Grande Prairie	3,145	5.3	12.4	9.7	12.4	48.2	4.1	5.8	2.1	100.0
Camrose	2,425	5.4	7.3	7.5	8.7	61.2	3.8	4.8	1.3	100.0
Lloydminster	1,980	6.0	12.2	8.7	10.8	53.1	3.2	3.5	2.5	100.0
Wetaskiwin	1,921	7.0	4.3	10.0	10.9	55.7	3.1	5.9	3.1	100.0

[a] Agriculture; forestry, fishing hunting and trapping; mining and quarrying.
[b] Transport, communications and storage.
[c] Wholesale and retail trade; personal and professional services.
[d] Finance, insurance and real estate.
[e] Public administration and defence.

Source: Dominion Bureau of Statistics, 1961 Census of Canada: Labour Force, Industry Divisions by Sex, Bulletins 3.2-2 (Ottawa, 1963); 3.2-3 (Ottawa, 1963); 3.2-4 (Ottawa, 1964); 3.2-5 (Ottawa, 1964).

engaged in manufacturing industries. Clearly, most of Red Deer's economically active population is involved in central activities, and the services thereby provided are available not only to the city's own population but also to that of the surrounding area. Red Deer has grown rapidly during the post-war period in population and in both number and range of commercial functions, testifying to its role as a major focus of regional centralization. Although the city's growth rate has fallen off in recent years, Red Deer grew more rapidly between 1941 and 1966 than any other centre between Edmonton and Calgary. It now has no rivals within that area to threaten its primacy as the major supplier of central goods and services.

The area in which Red Deer is situated is, like most of the settled portion of Alberta, heavily agricultural in its economic base. Oil and gas wells occur frequently throughout, but with the exploration phase now largely over the petroleum industry is an activity of small and decreasing importance as an employer of labour. The small incorporated places which occur within the area are almost without exception oriented toward rural service, very few being significantly affected by manufacturing industry or by resource-based activities such as coal-mining, oil and gas production or tourism. Certainly there appear to be no places within Red Deer's general trade area (Red Deer Regional Planning Commission, 1972, p. 20) which developed central place roles after first being established as manufacturing or resource-exploiting centres.

Delimitation of the System

Having established that Red Deer and the general region of south-central Alberta constitute a suitable area for study, it was necessary to determine a more definite study area boundary which would define the city's functional region and encompass its central place system. Several techniques are available, and are well enough detailed in the literature not to require further elaboration here (see, for example, Bracey, 1953; Green, 1955; Huff, 1963; Smailes, 1947; Yeates and Garner, 1971, pp. 95-106). In choosing a method for use in this study, it was decided that the boundaries of the area should reflect not simply the range of influence of Red Deer, but rather the territory over which the city is dominant as a supplier of high order goods and services. Such a definition serves to identify those tributary central places and rural areas which look to Red Deer rather than to other centres (notably Calgary and Edmonton) for requirements that cannot be satisfied locally, and excludes the places beyond for which Red Deer is of lesser importance. These terms of reference provide probably the most meaningful definition of Red Deer's central place system, in that the central places included are oriented to that city rather than toward any other.

The actual method of determining the areal extent of Red Deer's region of dominance is adapted from the work of Marshall (1969; see also Dahms and Forbes, 1971) and is intended to produce a result similar to that derived by Huff (1964). Briefly, the procedure was as follows. A line demarcating the approximate trade area of Red Deer (Red Deer Regional Planning Commission, 1972, p. 20) was used to provide a base for locating field interviews designed to establish the general pattern of shopping trip behaviour in south-central Alberta. Since a survey of individual consumers would have been prohibitively costly and time-consuming, the Marshall expedient of interviewing bank managers was followed. In each of 22 bank towns situated on either side of the line, informal interviews were carried out to establish the centres to which people travelled to obtain goods and services not obtainable locally. Since most people patronize more than one centre, the questions were designed to establish which centre was the focus of the greatest proportion of total out-of-town shopping trips. If a community's population patronized Red Deer more than any other centre, that community was designated as maintaining a "primary tributary" relationship to Red Deer. According to the definition outlined above, such places (including Olds, Ponoka, Rocky Mountain House and Stettler) belong to the Red Deer central place system. These primary tributary centres are in turn the major destinations for shoppers from lesser places. In such cases the smaller places were designated as belonging to the Red Deer system if Red Deer was the most frequently-patronized centre for goods and services not obtainable in the primary tirbutary centre. Residents of Castor and Coronation, for example, look primarily to Stettler to satisfy requirements that cannot be met locally, but for requirements of a still higher order Red Deer is the centre most patronized. Bank managers were also asked to indicate on a map the extent of their own town's areas of dominance.

The interviews thus provided a means of identifying the area within which most people look to Red Deer as the major centre for high order goods and services. The line itself is an estimate of a "spatial competitive equilibrium" (Huff, 1964, p. 37) in that consumers situated on it patronize other centres outside the system to the same extent that they patronize Red Deer. Conceptually, too, the derivation of the line is similar to that of the gravity formulation developed by Strohkarck and Phelps (1948) from the work of Reilly (1931) to estimate breaking points of trade orientation between competing centres. In practice, however, the gravity model technique is often difficult to apply (Berry, 1967, p. 41; Marshall, 1969, p. 69), particularly since it requires the prior identification of a town's competitors. Marshall's method, by contrast, identifies these competitors as an output of the exercise of delimiting a town's trade area. The technique used, while undoubtedly inferior to a full-scale consumer survey as a means of precisely defining Red Deer's area of dominance, appears to provide an acceptable level of accuracy with considerable economy of effort.

One modification was made to the method outlined. In the far western portions of Red Deer's area of dominance agricultural uses give way to extractive activities, and the few nucleated settlements present do not operate primarily as central places. West of a line joining Sundre, Rocky Mountain House and Hoadley, agriculture gives way to forest and the study area boundary here approximates the limit of continuous agriculture.

The trade area so defined (see Figure 2) takes on the somewhat elliptical form common to most places between Edmonton and Calgary (Battle River Regional Planning Commission, 1971; Red Deer Regional Planning Commission, 1960; Rendall, 1962). In all cases this shape is determined by the locations of competing centres and by the alignment of major roads. The locations of Edmonton and Calgary, the primate centres of Alberta, restrict the length of the north-south axis of Red Deer's area of dominance, but Camrose, Wetaskiwin and to a lesser extent Drumheller also play a role in restricting the areal spread of the city's influence. East along Highway 12, the influence of Red Deer appears to decline rather abruptly beyond Coronation. It appears likely that people in this area, faced with only a slightly longer drive to Edmonton or Calgary than to Red Deer in pursuit of high-order goods and services, prefer to patronize

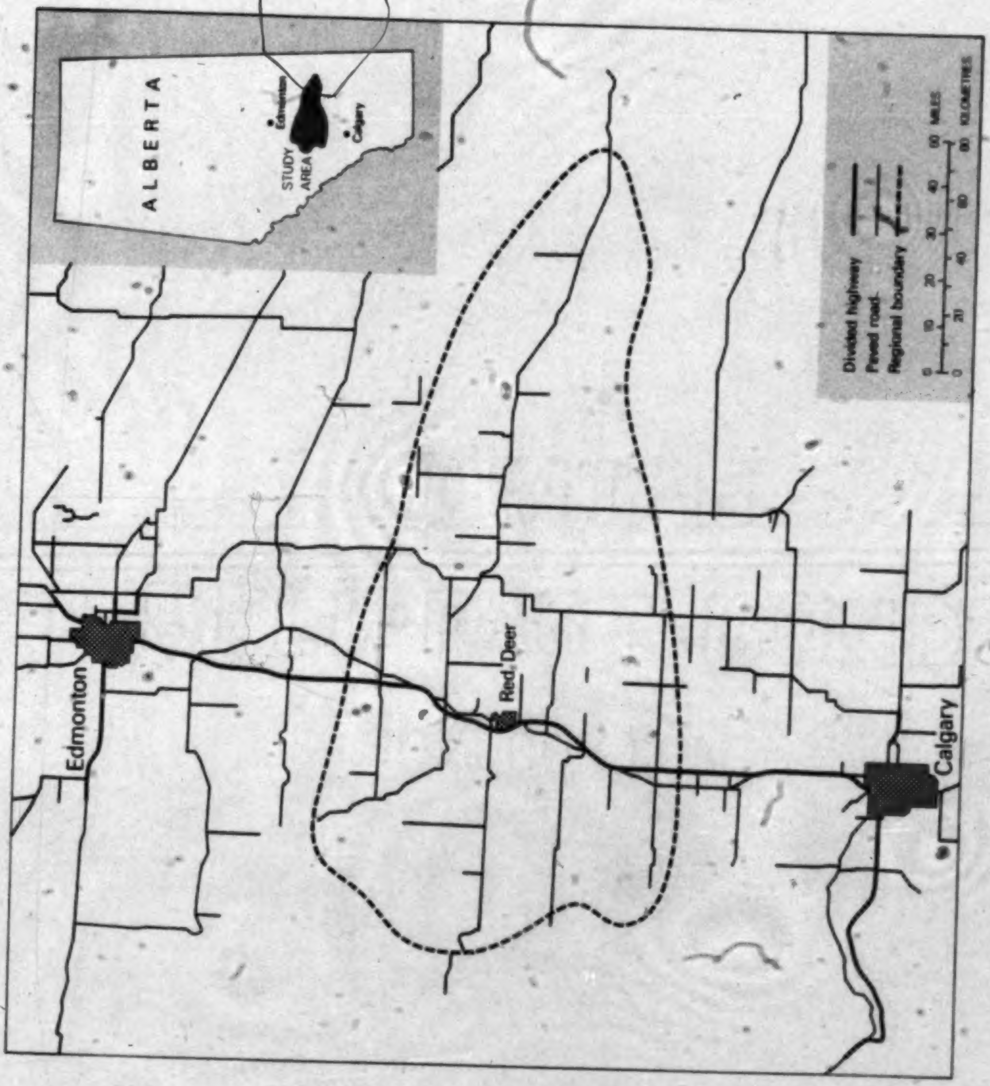

Figure 2 STUDY AREA: THE RED DEER REGION, 1971

the larger places. A consumer survey recently carried out by the Battle River Regional Planning Commission (1972) prompted a similar conclusion as regards travel to Edmonton from the far reaches of the Wetaskiwin and Camrose trade areas.

Within Red Deer's area of dominance, the principal economic activity outside of the incorporated places is agriculture; moreover this is the case throughout the region (Table 3). Except for two summer villages, all the incorporated places present within the region appear to function principally as service centres for surrounding rural populations. Excluding these two villages and Red Deer, all incorporated places had more than 35 per cent of their economically active populations in either trade or services (Table 4); if it were possible to include people engaged in other central activities but not enumerated under trade and services, this proportion would doubtless rise to over 50 per cent in almost all cases. Nevertheless some centres do maintain significant secondary specializations. Alix, Big Valley, Halkirk, Rimbey and Sundre are all involved in either coal mining or oil and gas drilling and production, while near the western boundary of the region Rocky Mountain House, Caroline and Sundre have parts of their labour forces involved in exploitation of the forest resource and in associated manufacturing industries. High employment concentrations in construction occur for Blackfalds, a dormitory centre for Red Deer, and Sylvan Lake, a summer resort and dormitory. Elsewhere most manufacturing activity involves the processing of agricultural products from surrounding areas and can be considered as industry of a central place type. The many small unincorporated places for which the census provides no information are almost exclusively made up of trade and service businesses (Dun and Bradstreet, 1971) oriented

TABLE 3

PERCENTAGE LABOUR FORCE COMPOSITION BY INDUSTRY, RURAL MUNICIPALITIES LOCATED WHOLLY OR PRIMARILY WITHIN THE STUDY AREA, 1961

Rural Municipality[a]	Number in Labour Force	Industrial Category									
		Agriculture	Other Primary[b]	Manufacturing	Construction	Transport[c]	Trade, Services[d]	Finance[e]	Administration[f]	Not Stated	Total
County 3	2,652	70.3	1.8	1.4	3.9	2.2	17.4	0.2	1.7	1.1	100.0
County 6	2,107	74.8	1.7	1.1	2.7	4.0	11.7	0.5	2.2	1.3	100.0
County 14	3,094	71.7	3.2	2.0	3.8	3.6	13.3	[illegible]4	1.4	1.6	100.0
Municipal District 53	1,101	84.5	2.2	0.3	2.1	3.6	6.6	0.1	0.3	0.3	100.0
Municipal District 55	4,838	63.5	1.8	1.6	4.7	3.2	13.0	0.4	10.6	1.2	100.0
Improvement District 65	1,698	63.1	8.3	3.3	6.6	5.1	11.6	0.1	0.8	1.1	100.0

[a] For the locations of these municipalities, see Figure 3.

[b] Forestry; fishing, hunting and trapping; mining and quarrying.

[c] Transport, communications and storage.

[d] Wholesale and retail trade; personal and professional services.

[e] Finance, insurance and real estate.

[f] Public administration and defence.

Source: Dominion Bureau of Statistics: 1961 Census of Canada, Labour Force by Industry Divisions and Sex, unpublished printout, Ottawa, 1965.

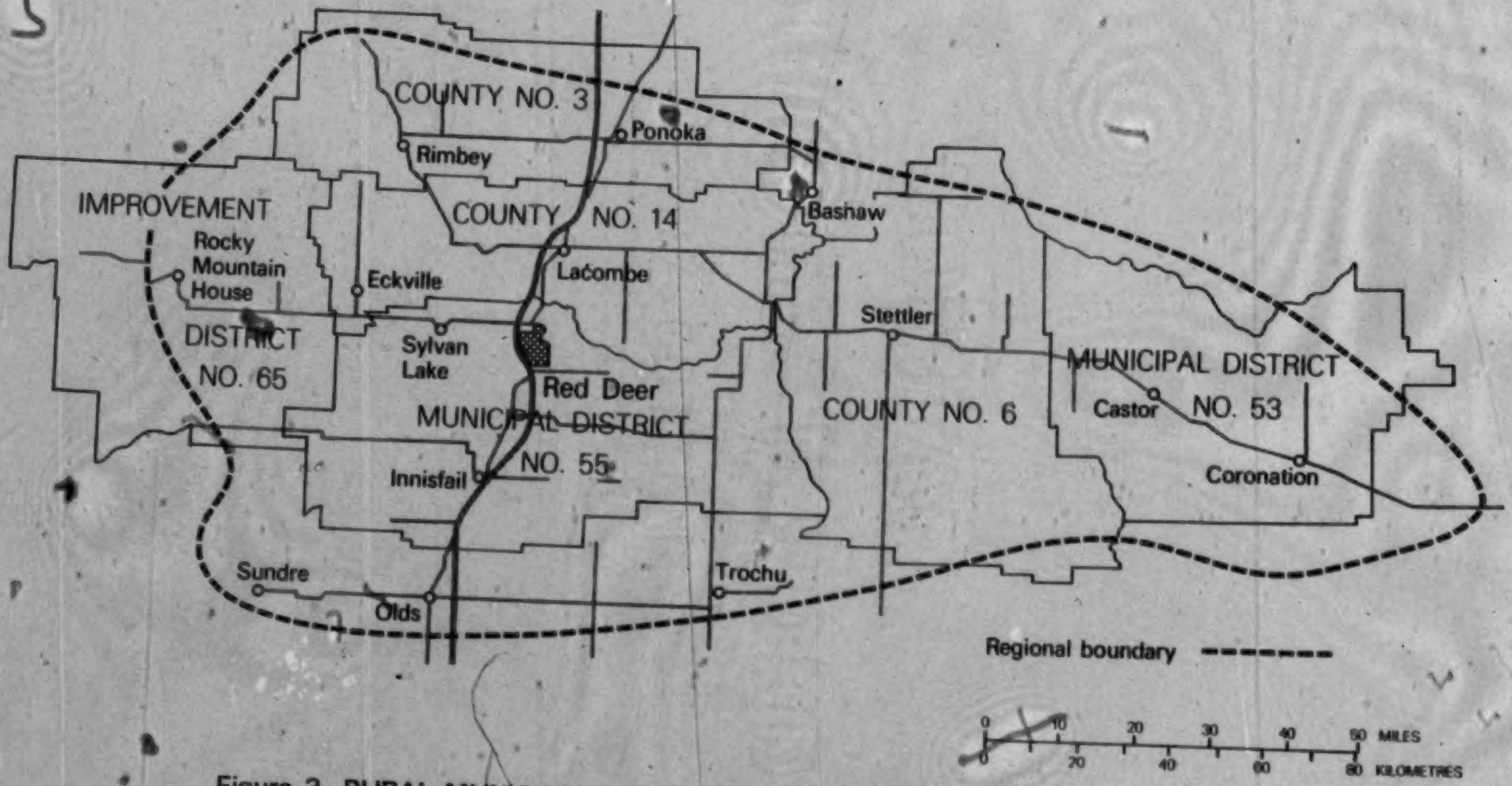

Figure 3 RURAL MUNICIPALITIES LOCATED WHOLLY OR PRIMARILY WITHIN THE RED DEER REGION, 1961

TABLE 4

PERCENTAGE LABOUR FORCE COMPOSITION BY INDUSTRY, INCORPORATED PLACES OF LESS THAN 5,000 POPULATION, STUDY AREA, 1961

Place	Number in Labor Force	Industrial Category								
		Primary Industries[a]	Manufac-turing	Construc-tion	Transport[b]	Trade, Services[c]	Finance[d]	Public Admin-istration	Not Stated	Total
Alix	193	12.4	12.4	10.3	13.5	40.9	2.1	2.6	4.7	100.0
Alliance	90	12.2	1.1	3.4	15.6	60.0	3.3	1.1	3.3	100.0
Bashaw	208	4.4	7.7	7.2	17.8	52.4	3.8	4.8	1.9	100.0
Bentley	185	11.9	5.4	6.0	17.8	51.9	2.7	2.7	1.6	100.0
Big Valley	151	28.4	0.7	5.3	20.0	35.1	3.9	3.3	3.3	100.0
Blackfalds	152	7.2	5.9	21.1	11.8	45.4	0.0	7.9	0.7	100.0
Botha	29	3.5	3.5	6.9	17.2	58.6	0.0	6.9	3.4	100.0
Bowden	154	13.0	7.2	11.0	14.3	37.0	1.3	14.9	1.3	100.0
Caroline	102	25.5	6.9	10.8	11.8	39.1	2.0	1.0	2.9	100.0
Castor	331	5.2	3.9	9.4	16.6	55.0	2.7	4.2	3.0	100.0
Clive	74	16.2	1.3	10.8	28.4	39.2	2.7	1.4	0.0	100.0
Coronation	314	8.6	2.2	8.3	19.4	48.1	5.1	3.5	4.8	100.0
Delburne	146	15.1	6.8	12.3	17.1	38.4	3.4	6.2	0.7	100.0
Donalda	100	8.0	11.0	6.0	12.0	41.0	5.0	6.0	11.0	100.0
Eckville	226	11.5	6.6	6.6	10.6	58.9	3.6	1.8	0.4	100.0
Elnora	85	12.9	3.5	7.1	21.2	49.4	3.5	1.2	1.2	100.0
Gadsby	29	3.5	0.0	13.8	31.0	44.8	3.4	0.0	3.5	100.0
Halkirk	47	21.3	0.0	6.4	21.3	48.9	2.1	0.0	0.0	100.0
Innisfail	788	8.4	7.0	9.5	10.1	48.1	3.3	10.2	3.4	100.0
Lacombe	1,005	9.6	5.1	9.9	12.2	51.4	4.1	4.9	2.8	100.0
Mirror	169	7.1	5.9	11.2	34.3	36.1	1.2	1.8	2.4	100.0
Olds	853	14.7	3.2	9.4	11.8	50.8	4.5	3.3	2.3	100.0
Penhold	122	8.2	10.7	4.9	9.9	42.6	0.0	22.1	1.6	100.0
Ponoka	1,479	3.7	4.3	8.0	7.1	66.6	3.6	4.7	2.0	100.0
Rimbey	451	14.2	3.3	10.9	9.8	55.4	1.3	2.9	2.2	100.0
Rocky Mountain House	804	11.3	6.5	20.5	8.6	39.1	2.2	7.3	4.5	100.0
Rumsey	42	14.3	0.0	2.4	26.2	42.8	2.4	0.0	11.9	100.0
Stettler	1,295	12.5	3.6	9.6	9.0	57.1	3.0	4.2	1.0	100.0
Sundre	239	24.3	5.4	14.6	11.3	35.2	1.2	3.8	4.2	100.0
Sylvan Lake	408	8.3	7.6	16.7	13.2	42.6	2.5	4.2	4.9	100.0
Trochu	292	12.3	1.7	6.9	12.3	62.0	4.1	0.7	0.0	100.0
Veteran	72	23.6	0.0	1.4	23.6	47.2	0.0	4.2	0.0	100.0

[a] Agriculture; forestry, fishing, hunting and trapping; mining and quarrying.

[b] Transport, communications and storage.

[c] Wholesale and retail trade; personal and professional services.

[d] Finance, insurance and real estate.

[e] Public administration and defence.

Source: Dominion Bureau of Statistics: 1961 Census of Canada, Labour Force by Industry Divisions and Sex, unpublished printout, Ottawa, 1965.

to rural service. In total, the region contained 125 places in 1941 (Figure 4). Most were by any definition small: even Red Deer in 1971 had a population of less than 28,000. The study thus deals with only the lower levels of the world-wide central place system.

Choice of Time Period

The study investigates the form of structural reorganization taken by the Red Deer central place system between 1941 and 1971. It has been noted above (pp. 17-19) that research involving too fine a temporal scale may be unable effectively to link cause with effect. With a time span of thirty years, such a problem is unlikely to arise. A still longer period, however, would have exacerbated the problem of data collection since sources of information on the characteristics of central places in Alberta are less complete for the pre-war than for the post-war period. Secondly, an extension of the time period further into the past would have resulted in the inclusion of the depression years, whose impact on the central place system of the Canadian prairies was electric (Britnell, 1939, pp. 27-29; Burnet, 1951, pp. 55-56). Volumes of trade fell drastically, numerous businesses were bankrupted and many small central places ceased to exist as service centres. By comparison the impact of World War II was minor. Finally, the selection of 1941 as a starting date affords some control over the impact on the system of factors other than those considered here, in the sense that these factors tended to operate in a single direction rather than fluctuating and thereby potentially causing erratic responses from the system. Per capita incomes, for example, have shown relatively steady growth during the postwar period (Drugge, 1969; Liguori, 1971) while the onset of a consistent trend toward rural depopulation in the study area was first

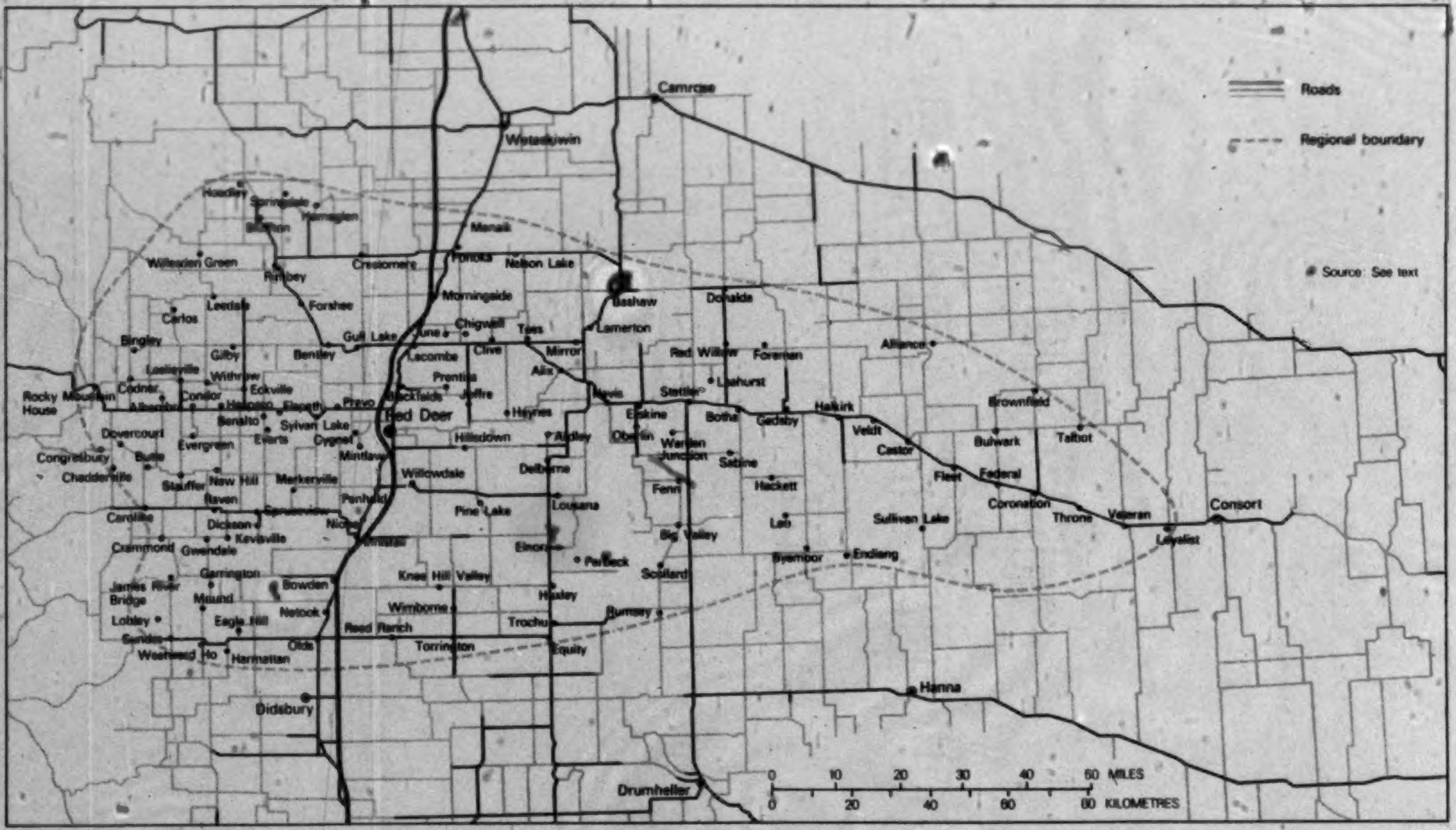

Figure 4 ●CENTRAL PLACES EVER PRESENT IN THE RED DEER REGION, 1941 - 1971 identifiable in the census of 1941 (see Crawford, 1962, Appendix I). During the thirty years to 1971 the total population of the area increased by nearly 50 per cent; overall, however, this growth was concentrated in the larger incorporated centres while the countryside lost population (Table 5). Significantly, Zimmerman and Moneo (1971) have noted that the period beginning in the late 1930s and continuing until about 1970 constitutes a coherent era in the development of the prairie space-economy; this was the period during which "machine farming, the automobile and truck, and the year round hard-surfaced roads came to the prairies" (p. 3).

TABLE 5

POPULATION CHANGES IN THE STUDY AREA, 1941-1971

Year	Total Population	Unorganized Rural Townships	Incorporated Places of 1,000 or more Population	Other Incorporated Places
1941	76,035	57,454	10,212	8,369
1951	80,970	52,081	19,049	9,840
1961	102,583	51,932	40,952	9,699
1971	110,320	47,267	52,723	10,330

Sources: Dominion Bureau of Statistics, 1951 Census of Canada, Vol. I, Population: General Characteristics, Ottawa, 1953.
Dominion Bureau of Statistics, 1961 Census of Canada, Vol. I-1, Population: Geographical Distributions, Ottawa, 1962.
Statistics Canada, 1971 Census of Canada, Vol. I-1, Population: Geographical Distributions, Ottawa, 1973.

THE FORM OF REORGANIZATION

Previous research has highlighted the existence of a number of regularities regarding the ways in which central place systems undergo reorganization as a result of variations between the growth behaviours of individual places (see above, pp. 19-29). At the regional level of whole systems of service centres, general tendencies have been recognized on the Canadian prairies (a) for some lower order centres to disappear, (b) for the hierarchy to become polarized over time between the high-order and low-order places, the middle ranks becoming depleted, and (c) for growth differentials to create over time an increasingly regular spacing among places of the same hierarchical level and for the system as a whole (Hodge, 1965b; Kariel, 1970; Semple and Golledge, 1970; Stabler, 1973; Stabler and Williams, 1973; Wong, 1972). Given the similarities between the space-economies of the study area and of the prairies as a whole, these tendencies may be expected to have characterized the temporal behaviour of the Red Deer system between 1941 and 1971.

To test for the existence of these patterns of change, each centre must first be classified, for each date, according to its level in the regional hierarchy. Questions of method in the assignment of centres to size levels or orders are well known to urban geographers, and no detailed discussion of the problems involved need be presented here (see Davies, 1966; Johnston, 1968; Leyes and Miller, 1974). Basically, however, there are two families of methods. The first and simpler of these is almost entirely subjective in approach, assigning centres to particular levels of the hierarchy on the basis of whether or not they possess certain (usually arbitrarily selected) functions (Borchert and Adams, 1963; Brush, 1953) or numbers of functions (Hodge, 1965b). Between group boundaries are usually ill-defined and there is no certainty as to the significance of the breaks determined. An alternative is provided by the so-called "objective" methods which involve the use of various group test or linkage algorithms to ascertain the locations in the array of sizes at which the most significant breaks occur (for examples, see Abiodun, 1968; Berry and Garrison, 1958; Tarrant, 1968). While it is possible using such algorithms to identify the major breaks, there is no objective means of determining the number of groups into which the set of places should be divided. An additional problem arises when such tests are applied to a system at two different dates in time. Even random movements involving only a few centres will produce different break-points, and there is no certainty that the breaks identified will meaningfully summarize the changes in the hierarchical functioning of the system (see Marshall, 1964, p. 42).

The method adopted in this study provides no ideal solution to the problems of delineating hierarchies, but it does at least attempt to define levels on the basis of the locations of the major breaks in an array of size values for centres. Lists of central activities present in the central places in each of the years 1941, 1951, 1961 and 1971 provided the basic data (see below, pp. 70-75 and Appendix A). Each such activity (function)[1] was regarded as contributing, in proportion to its frequency of occurrence, a certain amount of centrality to those places from which it was offered (see Marshall, 1969, p. 85). Individual occurrences (units) of these functions were assigned centrality values on the basis of Davies' (1967) location coefficient. For a single unit of a given function, the coefficient (C) is:

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[1] In using the relatively formalized terminology relating to activities in central places, the definitions suggested by Thomas (1960) and adopted by King (1962a) and Stafford (1963) are followed here. The term "function" is used to describe a central activity, the provision of which takes place in an "establishment" (usually a building or portion of a building, such as an office). Each single outlet of a function constitutes a "functional unit" (see Thomas, 1960, p. 11).

$$C = \frac{100t}{T}$$

where t represents one unit of the function in question and T represents the total number of units of that function present in the study area. The highest possible value of the coefficient (100) is ascribed to those functions for which there is only a single occurrence; a function with two hundred outlets in the same region has a coefficient of 0.5. To obtain a functional score for each place, the coefficients relating to its constituent units of functions are summed and the resultant values arrayed on a logarithmically-calibrated dispersion graph. Inspection of the graphs for each of the four years indicated those points in the array of scores at which breaks in the distribution occurred.

To the writer's knowledge the computation of scores such as these has previously been carried out only for single points in time. The application of the method over a period of years, however, poses the problem that functions which are disappearing as a result of obsolescence will be assigned higher and higher values over time. This would leave the mistaken impression that such functions, because they are occurring less and less frequently, are becoming activities of higher order. In the Red Deer region stores selling saddlery and harness equipment--numerous in the pre-automobile era--had disappeared by 1961, while general stores and tailoring establishments are becoming less numerous though showing little or no sign of centralizing in the larger centres. In these cases the location coefficients pertaining in 1941 were applied throughout the period; for all other functions the coefficients were recalculated for each of the four years.

The functional scores pertaining to the central places were used to allocate centres to levels in the regional hierarchy for each of the four years. By noting changes in the numbers of centres occurring at each level, it was a simple matter to discern alterations in the structure of the hierarchy since 1941. The same information was used to investigate the spacing of centres within the system. Mileage and travel-time distances separating near neighbours were measured, and mean values were established for all four years. The expectation that the system was, during the period under consideration, achieving greater regularity in the spacing of its member places was then tested by inspection of the degree of dispersion characterizing the arrays of spacing values recorded (Hodge and Paris, 1967). This method is simpler than statistical techniques such as nearest neighbour (King, 1962b; Pinder and Witherick, 1972) and quadrat analyses (Medvedkov, 1967; Semple and Golledge, 1970), which are commonly used in the description of point patterns. Both of these, unfortunately, are beset by deficiencies in modes of measurement and are dependent on restrictive definitions of areal frame (Garner, 1967, pp. 310-12; Getis, 1964, pp. 394, 397; King, 1969, pp. 89, 109). Neither provides more than "a rough appraisal of spacing features" (Cole and King, 1968, p. 191).

EXPLANATION OF REORGANIZATION

The previous section, which forms the basis for the discussion in Chapter III, is concerned with the forms of reorganization undergone by the system as a whole. In Chapter IV the focus shifts to the contribution of individual centres to reorganization at the system-wide level. Here an attempt is made to account for the patterns of growth and decline experienced by the places themselves. In part this attempt involves a replication of the analyses carried out by previous researchers; in addition it forwards hypotheses relating the growth performances of central places to their degrees of time-space convergence on other places in the system. In the replicative section, not all the hypotheses advanced in the past and noted in the introductory chapter are re-examined; neither time nor data would permit such an undertaking. Instead a few themes were selected for which data are readily available or could be obtained from information assembled for the analysis of the impact of time-space convergence on the system. The analyses are carried out using the chi-square test and a simple regression model. In all cases, the dependent variable is percentage change in post office revenue (a surrogate for retail trade) over a given period (see below, pp. 78-87). Four time periods are considered: the thirty-year span from 1941-1971, and its three constituent decades.

Replications

The replicative tests are considered only briefly here, since the expectations have already been discussed (see above, pp. 20-29). The independent variables are (a) initial size of place (defined in two ways for separate tests: functional score of place and post office revenue, both at the beginning of the period under consideration), (b) quality of the major intersecting road or highway (paved, gravel or earth); and (c) three measures of the relative location of centres (time-distance to the nearer of Edmonton and Calgary, time-distance to Red Deer and aggregate time-distance to the ten nearest neighbours[2]). These measures of relative location are intended to express the degree of separation of places from their rivals; growth is expected to be highest in those places which are situated at the greatest distance from competing centres. Similarly, the largest centres are anticipated to show the highest rates of growth, while places located on paved roads may be expected to grow more rapidly than those on surfaces of lower quality. The impacts of size and location on growth performance are examined using correlation and regression methods. The data relating to quality of road surface, however, are improperly scaled for such techniques. Here a contingency table framework is adopted, with the chi-square test being employed to test for the significance of differences between cells.

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[2] Most previous studies have considered the problem of relative location in terms of mileage distances. Some writers have implied, however, that amount of time expended in travel may be a more important consideration in the consumer's choice of centre than is distance in

Hypotheses

The first two hypotheses propose that as places converge upon one another in time-space, the alteration of consumers' spatial behaviour that occurs creates pressure for structural modification on the part of the system. As the time taken to traverse a given distance is reduced, so is the "subjective economic distance" which consumers ascribe to it (Christaller, 1966, pp. 108-09; for an exposition of related principles in behavioural terms, see Hinzmann, 1972). Time-space convergence of

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miles (see Huff, 1960, p. 163; Stabler, 1973, p. 35). Similarly, having chosen a centre, a consumer may opt for the route which takes him there in the shortest time. In either case it can be argued that time expenditure is the more meaningful measure of distance. First, it subsumes the notion of opportunity costs incurred in travel; secondly, given the possibility of reaching a particular place via several routes of varying quality, a shortest time-path route will tend to maximize the amount of travel on those high-quality surfaces where comfort is greatest and wear and tear on vehicles is least. On the latter point, Riordan (1965, p. 131) has noted that the quality of road surface is an important element in farmers' choices of delivery points for grain.

points, by extending the distance which can be covered per unit of time, operates to increase the range over which goods and services can be obtained from central places, and therefore to increase the potential size of trade areas. Provided that no consumers were left unserved prior to the onset of convergence, an overlapping of the potential trade areas of neighbouring places will now occur. But while all places are now more accessible to hinterland populations, the larger centres, with their wider ranges of functions and therefore greater nodality (Curry, 1960, p. 35) and convenience to the consumer (Lukermann, 1966, p. 21), will gain an advantage over their smaller rivals in the competition for custom. The larger centres are enabled increasingly to penetrate the trade areas of the smaller and to usurp their custom. As mobility increases, therefore, the terms of the distance-attractiveness tradeoff are altered such that the larger, more distant places become relatively more attractive than smaller places closer at hand (Cox, 1972, p. 214). Larger places enhance their focality and thus their locational utility to consumers. Viewed in this manner, convergence can be regarded as an element underlying the process of competition between central places and as part of the mechanism underlying the oft-noted relationship between size of place and propensity to grow.

This argument states that time-space convergence results in the growth of some centres and the decline of others (see also Figure 1, p. 37). If this is so, it follows that growing places will grow in proportion to their degree of convergence on neighbouring centres, and that declining places will show reductions in revenue in like manner. The hypotheses advanced are therefore tested by dividing the universe of centres into two groups: those showing increases and those showing decreases in post office revenue. Hence the expectation:

> That among growing places, those which show the highest rates of time-space convergence on their rivals will have increased to the greatest extent their locational utilities and will have experienced the highest rates of growth (H_1)

and

> That among declining places, those which show the highest rates of time-space convergence on their rivals will have experienced the greatest reductions in their locational utilities and will have shown the highest rates of decline. (H_2)

Before the testing of these hypotheses can proceed, the terminology employed must be given precise defintion. Growth and decline are expressed in terms of the direction of change evidenced by the post office revenues of central places between given dates. The degree to which a place has experienced convergence between those dates is expressed as the number of minutes saved per route mile on separate journeys between it and each of its ten nearest neighbours. The figure of ten is arbitrary and represents a rather crude operationalization for the term "rival," particularly for the larger centres which compete for trade over wide areas and with many lower-order places. In the absence of accurate data relating to the extent of trade areas, however, it is difficult to establish a rigorous method by which the rivals of central places can be determined. In a system of predominantly small centres vying for trade over very limited areas, it is unlikely that many centres compete for custom with large numbers of rivals. Both hypotheses are tested using regression analysis for the thirty-year period ending in 1971 and for each of the three decadal sub-periods.

Two further hypotheses based on the concept of relative location are forwarded in an attempt to measure the degree of spatial regularity present in the occurrence of growth and decline, and to measure the spatial pattern of the impact of growing places on surround-centres. Growing places, it has been argued, are expanding their trade areas and penetrating those of their neighbours. Loss of custom should first be experienced in places nearest to growing centres, and consequently such places will earlier suffer a reduction in the rate of growth of trade or an outright decline in trade than will more distant places. Similarly; once the influence of a rapidly-growing centre has expanded sufficiently that more than one neighbouring place is affected, the places nearest to the growing centre will be the ones most seriously affected in terms of loss of custom. Hypothesis three predicts the spatial pattern of the impact of growing centres on their neighbours, hypothesis four the time-path of that impact:

> That growing places exert detrimental effects on the growth rates of nearby places; and that this effect decreases with increasing time-distance from the growing places. (H_3)
>
> That the detrimental effects of growing centres on the growth rates of surrounding places are first experienced in those places nearest in time-distance to the growing centres and only later in more time-distant places. (H_4)

These two hypotheses are tested simultaneously using a near-neighbour correlation function devised by Hodgson (1972) to provide evidence of inter-place interaction in a growth pattern (see above, pp. 23-24). The test involves the construction of a matrix identifying the 1st, 2nd ... 10th nearest neighbours (where nearness is defined in terms of travel time) of each growing place. Again the post office revenue information is utilized to measure rates of change, and coefficients of correlation between the rates of change of each growing place and those of each order of neighbour are calculated. The analysis considers only the first ten near neighbours, however, since in a system of predominantly small central places no one place can be expected to have significant effects on relatively distant centres. A slight modification of Hodgson's method is introduced to take account of the fact that some places near the edges of the study area will have some of their ten nearest neighbours situated outside it. Data on the growth behaviour of these places are therefore incorporated in the analysis. Again, the analyses are carried out for the thirty-year period and for its constituent decades. In testing the validity of hypothesis three, all four sets of analyses are used; for hypothesis four only the analyses relating to the decades 1941-51, 1951-61 and 1961-71 are applicable.

SOURCES OF DATA

To describe the form of reorganization undergone by the Red Deer central place system and to test the hypotheses, three sets of data were obtained. Two of these (yearly revenue of post offices, and lists of central establishments) pertained to the characteristics of the central places themselves, and were used to establish the growth history of each place and the hierarchical structure of the system for each of the years 1941, 1951, 1961 and 1971. A third set comprised estimates of travel time between member places of the system for each of the four dates.

Enumeration of Central Functions

For each place within the Red Deer region, an attempt was made to compile, for 1941, 1951, 1961 and 1971, an inventory of all functions which existed primarily and directly to serve the final consumer resident in the area.[3] In fact, the lists fell somewhat short of this aim, because data were not available on all types of function for all years. Where functions appeared to be inconsistently listed in the various sources consulted, they were excluded from the inventories. As far as possible, the sources were checked against each other to ensure maximum completeness and reliability in the compilations; where the sources differed, a decision was made as to which was the most reliable, and that source was adopted for the particular function in question.

Three major directory sources were consulted. For retail activities, the most accurate listings were those contained in the business directories of Dun and Bradstreet, the American credit rating agency. Dun and Bradstreet directories have often been used in research into the functional make-up of urban places (Barber, 1971; Hodge, 1965a; Marshall, 1964; Smith, 1970; Thakur, 1972) and a variety of appraisals has been advanced as to their accuracy. Trewartha (1941) and Anderson (1967) were both rather critical in their evaluations, but Marshall (1969, p. 123) found that for retail firms the reference books were "remarkably trustworthy" while being less complete for other sectors. Comparisons of Dun and Bradstreet directories with other sources support Marshall's latter point: the directories fail to list many professional, recreational and other service activities. For retail functions the directories are more reliable, but Marshall's high degree of confidence may be misplaced. Because the books are completely revised only twice a year some new businesses are not tabulated in the bimonthly listings, and for the same reason some businesses are still recorded after becoming defunct. Small businesses employing only one person are usually (though not always) omitted, a characteristic which seriously affects the accuracy of the compilations for the smaller central places. In some cases trade centres of two or three businesses were omitted entirely or their establishments were recorded in the listings for larger centres. A further difficulty is that of non-comparability in the form of listing over time. Since the late 1940s the Standard Industrial Classification has formed the basis for recording the principal lines of business of each firm identified, but the classification itself has been altered on occasions since its inception. For 1941, enumerations were merely descriptive of function; in most cases, however, the description of businesses was sufficiently detailed to allow a code to be assigned with reasonable confidence.

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[3] While it was not possible to determine precisely which functions were not oriented primarily toward local residents, some can be assumed to exist for the purpose of tapping transient custom. Such functions--including motels, isolated service stations and eating places located on major highways and seasonally-operating stores in resort areas--are not integral parts of the central place system. Following Marshall (1969, pp. 126-27), these activities were omitted from the lists.

A second source of information on central functions was made up of yearly telephone directories. These directories were less reliable for the enumeration of retail establishments than were the reference books of Dun and Bradstreet, particularly for 1941 and 1951 when businesses in the region were not given Yellow Page listings. It is noteworthy, however, that the telephone and business directories have complementary strengths, a point made also by Marshall (1969, pp. 123-24). The telephone directories were found to be the more useful source for the enumeration of service functions, while the commercial reference books were preferred in most cases for retail outlets.

For some types of function a more authoritative source than either of those discussed above was the Canadian Almanac and Directory, an annual publication of the Copp Clark Company of Toronto. This almanac provided, for all four years, information on the locations of banks, treasury branch offices, libraries, legal firms, newspapers and establishments offering tertiary-level education. Finally, for a very few functions it was possible to obtain information from virtually unimpeachable specialist sources, and in these cases the directories were ignored. The functions, with sources in parentheses, were as follows: post offices (Canada Post Office), licensed hotels and liquor stores (Alberta Liquor Control Board), hospitals and nursing homes (Canadian Hospital Directory, supplemented for 1941 and 1951 by the Canadian Almanac and Directory), and grain elevators (Canadian Grain Commission). Other potential sources of information for individual functions (including the Alberta Medical, Dental and Pharmaceutical Associations) were contacted but proved unable to supply the required data. In these cases a reliance on the directories was unavoidable.

Despite the range of sources consulted, some omissions are apparent, particularly as regards community services. For some such functions (including rinks and meeting halls) no information was available. In other cases reliable data could not be found for all four years; churches, schools and county seats were omitted for this reason. Such exclusions are unfortunate, given the role of community functions in binding a local population together and giving it a corporate identity the effects of which may benefit other types of central functions. The closure of a school, for example, does not augur well for the commercial future of a central place, since schools perform a "latent function" in stimulating local economies and providing foci for cultural and recreational activities (Downey, 1965, pp. 49-50; Rogers and Burdge, 1972, p. 246).

Several other types of central activity were also excluded for reasons of incompleteness of the data record. Among these were some commercial recreational functions such as movie theatres and bowling alleys, together with periodic functions including race tracks and rodeos. Contracting firms were also omitted, in part because information on their locations appeared not to be complete for all four years, but more importantly because many such firms served, to an undeterminable extent, other firms and government agencies rather than serving the general public in a direct sense. Among the governmental functions, county seats and the offices of district home economists were excluded for lack of data. For retail uses the Dun and Bradstreet directories appeared to be complete as regards types of functions identified; among the personal services only barbers' shops were excluded because of inconsistencies among the data.

Critics of the Dun and Bradstreet directories, which formed the principle source of information on the locations of retail activities for this study, have suggested that the major deficiency of the directories lies in their enumerations for very small places (in particular, see Ferriss, 1950). In order to remedy this weakness, a field survey was undertaken. In places which in any one of the four years had housed fewer than six central establishments, informal interviews of local business people were carried out to ascertain the number and types of functions present in those years. Where a respondent with knowledge of the commercial history of a place could not be found, and in former central places now defunct, businessmen in nearby centres were interviewed to obtain the relevant information. In total, more than two-thirds of the central places now or at one time since 1941 operative in the area were surveyed. The survey proved to be useful in increasing the accuracy of the lists of central establishments for these places. In several cases establishments not recorded by the directories were added, while in other cases establishments listed were found to have become defunct at an earlier date. In still others, the descriptive classifications ascribed to an establishment were altered. Several instances of a store's location having been incorrectly reported in the Dun and Bradstreet reference books were also corrected. Understandably, however, respondents were not in all cases familiar with or able to remember clearly the situation of two or three decades ago. For this reason, and because the survey was restricted to the small places only, some inaccuracies doubtless remain in the compilations. Yet despite the caveats noted and the fact that the sources consulted were not entirely contemporaneous, it is felt that the final enumerations provide a relatively complete and accurate picture of the types and numbers of central functions operative in the area in 1941, 1951, 1961 and 1971. Table 6 lists the 82 functions identified, together with the number of places in which each function occurred in each of the four years. For any one of these years a more complete listing could have been obtained; because of inconsistencies over time in the reporting of certain functions, however, comparison of lists would have been rendered difficult and spurious trends might have been identified.

The Patronage of Central Places

Alterations in numbers of central functions or establishments,

TABLE 6

CENTRAL FUNCTIONS IN THE STUDY AREA, 1941-1971

Type of Store or Service	Number of Places in which the Function Occurs			
	1941	1951	1961	1971
Post office	104	96	88	58
General store	100	97	87	74
Grain elevator	82	82	80	62
Machine shop, blacksmith	56	49	31	26
General automotive repair	51	50	43	36
Service station	43	52	53	48
Restaurant, cafe, coffee shop	40	42	40	33
Meat market	38	34	27	21
Bulk oil	37	43	47	42
Hardware	37	38	33	29
Hotel with bar, tavern	36	38	35	36
Farm equipment	45	40	36	28
Grocery	35	36	33	27
Building materials	34	39	34	29
Pool hall	33	33	26	10
Drug store	27	26	21	18
Shoe repairs	27	24	12	5
Saddlery, harness equipment and repairs	24	5	0	2
Bank, treasury branch, credit union	22	27	27	24
Creamery	22	22	22	15
Automobile sales	20	27	23	21
Law office	20	18	13	12
Retail bakery	18	18	16	14
Physician	17	19	16	17
Less-than-daily newspaper	15	16	16	17
Funeral parlour	13	11	12	9
Jewellery, watch repair	12	14	15	14
General hospital	12	14	14	16
Women's clothing	12	13	13	12
Furniture	11	12	11	13
Insurance, real estate agency	10	21	24	25
Household, electrical appliances	10	16	16	16
Electrical appliance repair	9	18	19	16
Tailor	9	5	3	2
Men's, boy's clothing	8	12	12	13
Dry cleaning, laundry	8	8	7	12
Farm supplies (feed, seeds, fertilizer)	[illegible]	15	17	23
Beauty salon	7	14	15	23
Variety, gift, novelty shop	7	13	18	22
Dentist	6	9	10	8
Shoe shop	6	5	7	8
Automobile parts, accessories	5	8	9	14
Dry goods, yard goods	5	8	8	7
Chiropractor	5	4	4	9
Photographer, photographic studio	4	7	10	8

TABLE 6
(Continued)

Type of Store or Service	Number of Places in which the Function Occurs			
	1941	1951	1961	1971
Liquor sales	4	6	13	15
Public library	3	11	11	11
Family clothing	3	6	5	5
Confectionery	3	6	4	6
Specialized automotive repair (e.g. electrical, glass, radiator and transmission repairs; body shop)	2	10	10	12
District agriculturalist	4	5	7	7
Department store	2	3	6	8
Accountant's office	2	7	8	10
Children's clothing	1	5	7	3
Veterinary services	1	4	10	11
Florist	1	4	5	7
Optician, optometrist	1	3	4	7
Household furnishings	1	2	2	3
Psychiatric hospital	1	2	2	2
Book shop, stationery	1	1	3	5
Institute of tertiary education	1	1	1	2
Sporting goods (gunsmith, marine equipment)	0	2	6	12
Physiotherapist	0	2	1	4
Fuel (propane, bottled gas)	0	1	5	10
Upholstery, furniture repair	0	1	3	4
Nursing home	0	1	3	10
Motorcycles, sales and service	0	1	2	6
Music store	0	1	2	3
Automobile rental	0	1	1	1
Monuments, tombstones	0	1	1	1
Trailer homes	0	0	3	4
Travel agency	0	0	1	3
Employment agency	0	0	1	2
Daily newspaper	0	0	1	1
Pet shop	0	0	1	1
Secretarial college	0	0	1	1
Equipment rental	0	0	0	3
Toy shop	0	0	0	2
Antiques	0	0	0	1
Cameras, photographic supplies	0	0	0	1
Health foods	0	0	0	1
Marriage counselling	0	0	0	1

Source: see text, pp.70-75.

while used by some researchers to determine the extent of growth and decline over time among central places (for example, Hodge, 1965b), provides only a very coarse index of change. Enumerations of functions are best used to provide information on the types of goods and services available in central places, but they do not allow conclusions to be drawn on the extent to which these places are patronized by the public which they serve. Unfortunately, data from which such conclusions can be drawn are difficult to obtain. For non-trade functions including many community and governmental activities, indeed, no information is available on a systematic basis from which degree of use by the public can be derived. Data on retail and service trading functions is far from complete: the only Canadian source for which trade data are available is the decennial major census which lists the dollar volume of business for centres with populations of 1,000 or more. A surrogate for trade volume which is available for a wider array of places, however, is post office revenue, which has been published annually for all post offices in Canada since Confederation. Jones (1965, pp. 3-5) has shown that in British Columbia post office revenue is closely correlated with retail and service trade for places of over 1,000 population. For Alberta high correlations also occur; moreover the strength of the coefficients remained stable at r values around +0.90 between 1941 and 1961. Notably, post office revenue appears to be a more efficient and stable surrogate for volume of trade than does population (see Table 7). If the assumption is made that strong correlations also hold between post office and trade revenues for smaller places (that is, places of less than 1,000 people, it becomes apparent that changes in post office revenue can be used to indicate changes in volume of business carried

TABLE 7

SPEARMAN RANK CORRELATIONS OF POST OFFICE REVENUE AND POPULATION WITH RETAIL AND SERVICE REVENUE, ALBERTA PLACES OF MORE THAN 1,000 POPULATION, 1941-1961

	Retail and Service Revenue 1941	 1951	 1961
Population	+0.69***	+0.79***	+0.76***
Post Office Revenue	+0.90***	+0.91***	+0.89***

*** Significant at the .001 level

Sources: Dominion Bureau of Statistics: 1941 Census of Canada, Vols. 2 (Population: Local Subdivisions); 10, 11 (Merchandising and Services).
Dominion Bureau of Statistics: 1951 Census of Canada, Vols. 1 (Population: General Characteristics); 7, 8 (Distribution).
Dominion Bureau of Statistics: 1961 Census of Canada, Vols. 1 (Population: Geographical Distributions); 6 (Retail and Service Trade).
Post Office Department of Canada: Report of the Postmaster General, 1942, 1952, 1962.

out in all centres which include a post office among their central functions. On the basis of this assumption, post office revenue is adopted as a suitable proxy for amount of business carried out in central places. Gross revenues were obtained for all post offices in the Red Deer region.[4]

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[4] It has been suggested (above, pp. 13-14) that analyses of reorganization in central place systems should ideally be directed at changes in the centrality of places rather than changes in size. To determine centrality, however, would require that the total trade of a place be partitioned into its basic and non-basic components, as in the method of economic base analysis (see Pfouts, 1956). This could be achieved in an approximate manner by determining per capita trade for the region as a whole and then calculating for each place the volume of trade carried out in excess of that accounted for by its own population

To make the revenue data more meaningful for the analysis of growth and decline, two modifications were instituted. The first and simpler of these was to express revenue values for the years ending March 31 of 1942, 1952, 1962 and 1972 as annual means for the three-year periods 1941-43, 1951-53, 1961-63 and 1971-73 respectively. In sum, this modification had the effect of smoothing minor oscillations in revenue totals such that insurance was provided against the selection of a single year in which revenues might have been abnormally high or low for particular places. The second adjustment to the raw data was necessitated by the fact that post office revenues are reported in current dollars. As is true of most consumer items, the goods and services provided by post offices are subject to price inflation as a result of irregular, often frequent adjustments to rates which render meaningless the direct comparison of the revenues of an office for different years. To allow such comparisons to be made, the raw revenues must be converted to constant dollars. Unfortunately the Canada Post Office maintains no price index system from which the conversion could have been made, and composite indexes such as the Consumer Price Index are inapplicable to individual groups of specialized goods and services which may exhibit unique patterns of price behaviour over time. Accordingly an index was devised specifically for this study.

(Anderson, 1967, pp. 46-48; Preston, 1970; 1971). The method has its deficiencies (particularly its assumption that per capita trade is constant throughout the area), but its use here was vitiated by the fact that the majority of the centres in the region are unincorporated. For such places, consistent and accurate data on size of population are not available for all years under consideration. In any case, the use of post office revenues is felt to be superior to the use of population in measuring size of place.

Ideally an index system used to convert postal revenues from current to constant dollars should incorporate a series of weights corresponding to the relative importance of the contribution of each item or service to total revenue. Unfortunately no data are available which would allow weights to be assigned, in part because the range of services provided by the Canada Post Office has not remained constant over time. It is notable, however, that postage supplies (stamps, aerogrammes and meter impressions) are by far the most important generators of income for the Canada Post Office; moreover, their combined contribution has remained almost stable at near 93 per cent of total incoming revenue over the period since 1940-41 (see Table 8). Given the high degree of dominance of postage supplies over all other sources of revenue, it appears reasonable to construct an unweighted aggregates index (Hamburg, 1974, pp. 366-67) based solely on the contribution of postage supplies to overall revenue. These items, however, have been subject to periodic rate increases during the period under consideration. To allow an estimate to be made of the effect of such increases, information was obtained relating to the number of pieces of mail originating within Canada for single years since 1946-47 (personal communication, Mr. S. R. Dunn, Canada Post Office, Ottawa). It was then possible to calculate, for individual years, the cost of posting a hypothetical "average" item of mail in Canada. The calculation was made by dividing dollar revenue accruing from the sale of postage by number of pieces of mail posted. For 1961-63, the cost per item was 4.66 cents; a decade later it had risen to 9.86 cents. In other words, for the same quantity (though perhaps a higher quality) of service, the cost to the consumer more than doubled between 1961-63 and 1971-73 in terms of current dollars. If

TABLE 8

TOTAL REVENUE AND REVENUE FROM THE SALE OF POSTAGE SUPPLIES, POST OFFICES IN CANADA, 1941-1973

Year Ended 31 March	Total Revenue (millions of dollars)	Revenue from Postage Supplies (millions of dollars)	Postage Supplies as a Percentage of Total Revenue
1973	557.8	529.3	94.9
1972	486.7	458.9	94.3
1971	418.3	393.9	94.2
1970	430.6	406.8	94.5
1969	363.5	342.9	94.3
1968	327.2	307.1	93.9
1967	295.5	277.0	93.7
1966	276.1	257.8	93.4
1965	263.8	246.6	93.5
1964	235.8	219.2	93.0
1963	222.3	207.7	93.4
1962	213.5	198.6	93.0
1961	202.0	187.2	92.7
1960	193.6	179.9	92.9
1959	183.3	169.9	92.7
1958	177.4	164.9	93.0
1957	167.8	155.8	92.8
1956	158.2	146.3	92.5
1955	151.7	140.1	92.4
1954	129.7	119.9	92.4
1953	129.3	119.9	92.7
1952	122.3	114.0	93.2
1951	105.5	98.1	93.0
1950	101.3	93.5	92.3
1949	96.0	89.5	93.2
1948	91.6	85.3	93.1
1947	86.4	79.6	92.1
1946	83.8	77.5	92.5
1945	79.5	73.7	92.7
1944	73.0	68.8	94.2
1943	59.2	55.1	93.1
1942	55.5	51.5	92.8
1941	48.1	44.9	93.3

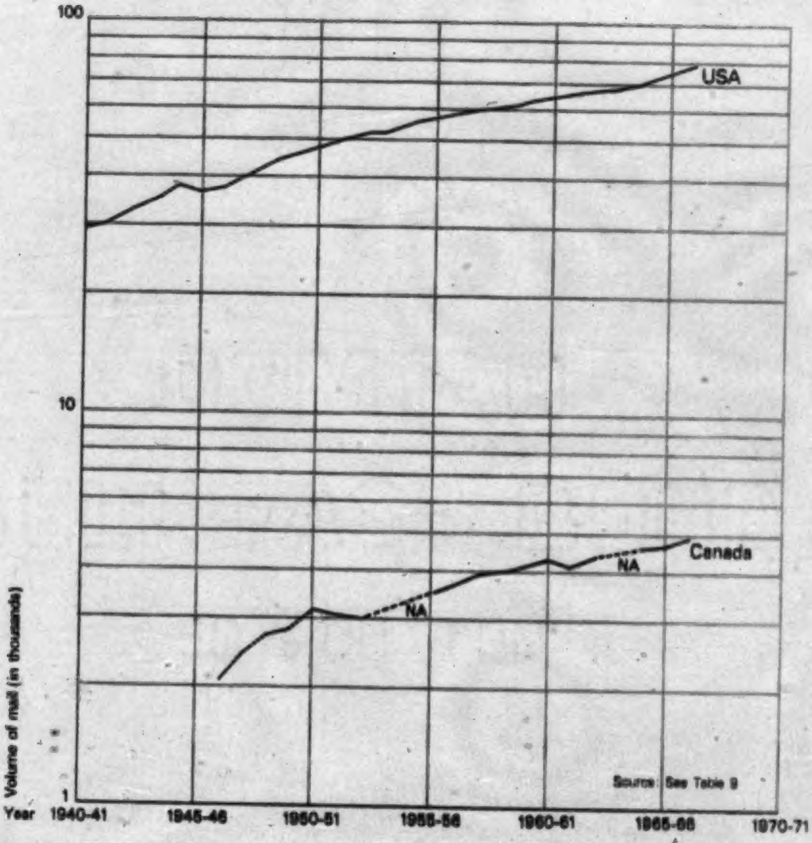
Sources: Post Office Department of Canada: Report of the Postmaster General (annually), 1941-1966 inclusive, Ottawa.
Canada Post Office: Annual Report, 1967-1973 inclusive, Ottawa.

this degree of increase (2.116 times) is considered as an "inflation factor," it can be used in the following manner to convert 1971-73 current dollar revenues to their equivalent in constant dollars, using 1961-63 as the base period:

$$\frac{\text{1961-63 Cost per Piece}}{\text{1971-73 Cost per Piece}} \times \text{1971-73 Current Dollar Revenue}$$

This formula was applied, for 1951-53 and 1971-73 revenues, to all post offices in the Red Deer region, and the resultant values were used as surrogates for the calculation of rates of growth and decline in trade. No counts of pieces of mail were available for 1941-43, however, and accordingly a procedure was adopted whereby an estimate could be derived for those years. Mail counts published by the United States Post Office Department (1971) were graphed on semi-logarithmic paper alongside Canadian counts for that period (1946/47 to 1966/67) for which comparable information was obtainable. It was found that mail volumes behaved similarly between the two countries, although the Canadian trend was rather more erratic than the American (Figure 5). Overall, the volume of Canadian mail rose by 96.09 per cent between 1946/47 - 1948/49 and 1964/65 - 1966/67, while that in the United States increased by 86.25 per cent over the same period. If it is assumed that Canadian volume increased between 1941/43 and 1947/49 in the same ratio (96.09 : 86.25) to the known American increase (31.56 per cent), an estimate of 1941-43 mail volume can be obtained for Canada. The value derived from this procedure (5,356,000,000 pieces) was then applied to postage revenue to obtain an index value for 1941-43(see Tables 9 and 10).

Even discounting the inadequacy of the method of conversion for 1941-43, the index system outlined is subject to some deficiencies.



Source: See Table 9

Figure 5 TRENDS IN VOLUME OF MAIL: UNITED STATES OF AMERICA (1940/41-1966/67) AND CANADA (1946/47-1966/67)

TABLE 9

VOLUME OF MAIL: THE UNITED STATES OF AMERICA (1940/41 - 1966/67) AND CANADA (1946/47 - 1966/67)

Year[a]	United States	Canada
	(millions of pieces)	
1972/73		4,751
1971/72		4,713
1970/71		4,553
1969/70		4,915
1968/69		4,957
1967/68		4,998
1966/67	78,367	4,905
1965/66	75,607	4,677
1964/65	71,875	4,613
1963/64	69,676	N.A.
1962/63	67,853	4,393
1961/62	66,493	4,093
1960/61	64,933	4,255
1959/60	63,675	4,184
1958/59	61,247	4,002
1957/58	60,130	3,937
1956/57	59,078	3,698
1955/56	56,441	3,521
1954/55	55,234	N.A.
1953/54	52,213	N.A.
1952/53	50,948	3,011
1951/52	49,905	3,072
1950/51	46,908	3,188
1949/50	45,064	2,806
1948/49	43,555	2,713
1947/48	40,280	2,435
1946/47	37,427	2,091
1945/46	36,318	
1944/45	37,912	
1943/44	34,931	
1942/43	32,818	
1941/42	30,118	
1940/41	29,235	

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[a] The Post Office fiscal year in the U.S.A. ends on June 30; in Canada on March 31.

Sources: United States Post Office Department: 1970 Annual Report of the Postmaster General, Washington, 1971, pp. 140-41. Personal communication, Mr. S. R. Dunn, Canada Post Office, Ottawa.

TABLE 10

POST OFFICE REVENUE INDEX, 1941-43 TO 1971-73

Period	Pieces of Mail (millions)	Postage Revenue (millions of dollars)	Cost per Piece (cents)	Index (1961-63 = 100)
1971-73	14,017	1,382.1	9.86	211.6
1961-63	12,741	593.5	4.66	100.0
1951-53	9,271	332.0	3.58	76.8
1941-43	5,356	151.5	2.83	60.7

Sources: Canada Post Office: Annual Report, 1971; 1972; 1973; Ottawa.
Post Office Department of Canada: Report of the Postmaster General, 1951; 1952; 1953; 1961; 1962; 1963; Ottawa.
Personal communication, Mr. S. R. Dunn, Canada Post Office, Ottawa.

First, it assumes a standard average item of mail the characteristics of which do not vary over time. Yet it is possible that mails are becoming, for example, comprised of higher or lower proportions of bulky items, with attendant ramifications for revenues. Apart from isolated tabulations of changes in the proportional contribution of the different classes of mail to total volumes, however, few data appear to exist on temporal variations in the characteristics of the mails in Canada. In any case, occasional comments in the department's annual reports suggest that revenue increases derive overwhelmingly from rate changes and increases in volumes of mail (the two components of change explicitly incorporated in the index) rather than from systematic variations in the characteristics of the mails themselves (see Post Office Department of Canada, 1955, p. v; 1962, p. iii; and Canada Post Office, 1972, p. 5). Secondly, the data on which the index is based relates to Canada as a whole; little information is available on a temporal basis for Alberta or for individual post offices. To the extent that individual offices deviate from the national pattern of business, the index devised will not provide an accurate means of converting current dollars to a constant base. It has been shown above (Table 8) that for Canada as a whole postal supplies have during the post-war period constituted a near-constant 93 per cent of total incoming revenue annually. This fraction is not highly variable for individual post offices: in the Alberta South-Central (Postal) Area, which encompasses the entire Red Deer region, almost nine-tenths of all offices derived 85 per cent or more of their revenues from the sale of postage supplies during the April-June quarter of the 1973-74 financial year (Canada Post Office, 1973b, pp. 302-05). By the limited evidence available from which the index can be evaluated, it appears that its deficiencies are in practice more apparent than real.

Measurement of Time-Space Convergence

A major input to structural reorganization in central place systems, it has been argued, is the increased spatial mobility of the consumer. In this study, the degree of increase in mobility is assumed to be a function of the degree to which places have converged in time-space as a result of improvements to vehicles and to the route network.

While travel times on Alberta roads and highways have been greatly reduced during recent decades (Anderson, 1967, p. 155), little information exists as to the degree of reduction and the consequent degree of time-space convergence of points which has occurred. The same is true for other areas of North America. Travel time data are relatively plentiful for intra-city vehicular trips (see, for example, Halen et al., 1963; and Trueblood, 1952) but not for trips on the open road. Those few writers who have attempted to place numerical values on travel times for inter-centre trips have derived very different values for similar types of highway (see Table 11). All of the values shown in this table are estimated, but the basis of estimation varies from source to source. Anderson's (1967) values were derived from interviews of rural dwellers in central Alberta, Janelle's (1969) from records held by the Michigan State Highway Department. The estimates forwarded by Rendall (1962), Riordan (1965) and Smith (1970) appear not to have been based on supporting evidence; with the exception of Riordan's these values appear to be overly high when comparisons are made with other sources. The estimates for Greyhound bus journeys were garnered from contemporary timetables, making an assumption of two minutes for each listed stop for which information on duration of stop was not given.

Because of the incompleteness and variability of the data relating to open-road travel times, it was necessary to adopt a method by which travel times could be estimated for each of 1941, 1951, 1961 and 1971. A considerable body of information exists relating to "spot speeds" (the speeds of vehicles passing a given point) on rural highways in North America. Such speeds are almost invariably recorded under highly favourable conditions in which vehicular speeds are at or near the maxima attained on given journeys. Spot speeds, recorded for free-flowing (out of platoon) vehicles travelling on level tangents under low-flow, dry, daytime conditions are necessarily higher than the "overall" speeds which apply over distances and which involve various types of delay (for methods of measuring spot speeds and discussion of the conditions under which they are recorded, see Kennedy _et al_., 1966, pp. V1-V5; and Pignatario, 1973, pp. 116-21). Spot speeds for different classes of roads were therefore transformed to derive the estimates of

TABLE 11

ESTIMATES OF MEAN TRAVEL TIME FOR DIFFERENT CLASSES OF ROAD (EXPRESSED IN MILES PER HOUR)

Type of Road	1941	1951		1961		1971
Divided Paved Highways						
Greyhound Buses (Alberta)						54 (1971)
Janelle (Michigan)					55 (1965)	
Other Paved Highways						
Anderson (Alberta)					36.5 (1965)	
Greyhound Buses (Alberta)			43 (1955-56)	45 (1961)		50 (1971)
Janelle (Michigan)	40 (1940)				45 (1965)	
Rendall (Alberta)				60 (1961)		
Riordan (Manitoba)					40 (1965)	
Smith (Minnesota)	43 (1940)	50 (1950)		57 (1960)		
Gravel Roads						
Anderson (Alberta)					27 (1965)	
Rendall (Alberta)				45 (1961)		
Riordan (Manitoba)					30 (1965)	
Smith (Minnesota)	31 (1940)	40 (1950)		47 (1960)		
Earth Roads						
Riordan (Manitoba)					20 (1965)	
Smith (Minnesota)	23 (1940)	30 (1950)		39 (1960)		

Sources: Alberta Department of Highways: unpublished materials on timetables for Greyhound Buses, 1955, 1956, 1961, 1971.
Anderson, J.: Change in a Central Place System: Trade Centres and Rural Service in Central Alberta, unpub. M.A. thesis, University of Alberta, 1967, p. 16.
Janelle, D. G.: Spatial Reorganization: a Model and a Concept, Annals, American Association of Geographers, 59, 1969, p. 65.
Rendall, H. A.: The Trade Areas of Camrose, Wetaskiwin and Ponoka, unpub. M.A. thesis, Univeristy of Alberta, 1962, p. 65.
Riordan, E. B.: Spatial Competition and Division of Grain Receipts Between Country Elevators, unpub. M.Sc. thesis, University of Manitoba, 1965, p. 44.
Smith, H. R.: Regional Growth, Central Place Development and Functional Change: River Bend Area, Minnesota, unpub. Ph.D. thesis, Michigan State University, 1970, p. 23.

overall (travel time) speeds. Topographic considerations are of minor import in the Red Deer region and were excluded from the calculations.

Data on mean spot speeds in various parts of North America were obtained from several published sources (Manitoba Department of Highways, 1971; Matson, et al., 1955; Paustian, 1940; Pignatario, 1973; Saskatchewan Department of Highways and Transportation, 1973; United States Department of Transportation, 1967) and from unpublished records maintained by the Alberta Department of Highways. For 1961 and 1971 a fairly complete record was available for paved roads, but for earlier years and for non-paved surfaces data were scanty and some interpolation was necessary. In transforming mean spot speeds to mean overall speeds a constant conversion factor was not employed because of variations by type of road in the difference between the two speed measures. Instead, the following conversion factors (mean overall speed as a percentage of mean spot speed) were adopted: the four-lane divided paved highway (ninety), other paved highways (eighty), and gravel roads (seventy). While there is scope for error in the adoption of these conversion factors, the values derived appear to provide a reasonable fit to those estimates of travel time which were based on primary sources such as surveys and timetables (see above, p. 88 and Table 11). In the following paragraphs the factors which operate to differentiate spot and overall speeds between different classes of roads are briefly discussed.

Four-lane divided highway.--Only one divided highway traverses the Red Deer region. This road bypasses all towns, and fixed delay instituted by traffic control devices (including speed limits) is minimal. The highway provides a high-speed route, with wide shoulders and gentle curvatures allowing a maximum of ease in overtaking and the general maintenance of high speeds (Emmerson, 1970). Under such conditions motorists are enabled to spend high proportions of total travelling time moving at or near their preferred speeds (Webster, 1966, p. 38), and accordingly the highway has a high travel-time efficiency relative to levels of spot speed.

Other paved highways.--These highways do not in all cases bypass towns, and platoon movement is more common at similar volumes than on four-lane highways as a result of the greater difficulties involved in passing. Some delays occur, both as a result of the traffic stream and because of the low speed limits which apply within built-up places, but in general fixed delay instituted by traffic control devices is relatively unimportant. Again, these highways have a relatively high travel-time efficiency, although the dispersion of speeds below the maxima attained is doubtless greater than for four-lane routeways.

Gravel roads.--Gravel roads are rarely if ever congested, but carriageways are generally narrower than on paved highways. Surfaces are rougher and more variable in quality over given tangents, and this variability likely tends to reduce average speeds in the direction of those maintained over the poorer sections. For the late 1930s, Paustian (1940, p. 23) has estimated that spot speeds on gravel were approximately ten miles per hour lower than those on hard surfaces. This differential appears to have been maintained or slightly increased over time (Saskatchewan Department of Highways and Transportation, 1973, pp. 69-72).

Unimproved (earth) roads.--Earth roads are narrow and have low-quality surfaces which impose heavy restrictions on speed, particularly under wet conditions. In keeping with the now-minimal importance of earth roads for mass transportation, little research has been carried out in recent decades on spot and overall speeds attained on unimproved surfaces. For the mid-1930s, however, Moyer and Winfrey (1939, p. 41) found that travel times for given distances were approximately 50 per cent greater on earth than on paved roads. Given the lack of expenditure for maintenance (as distinct from upgrading to gravel or paved surfacing) on earth roads, it is likely that the differential has widened considerably since the 1930s. In general the quality of earth roads is sufficiently low that the tendency of vehicular improvements to permit the attainment of greater speeds has been, to all intents and purposes, negated.

Table 12 presents estimates of mean travel-time speeds for the four classes of roads distinguished in the Red Deer area between 1941 and 1971. It will be noted that for all categories except for the earth roads, a progressive increase in overall speeds has occurred; moreover, the higher the quality of road, the greater is the absolute increase. That increase, of course, is attributable to vehicular improvements and to within-class improvements in the quality of roads.

The values shown in Table 12 were used as follows to derive estimates of the degree of time-space convergence experienced by the member places of the Red Deer central place system. A schematic map of the road network was constructed, and all places and road junctions were given numerical codes. For each direct link between points on this map, five pieces of information were assigned: the length of the link in

TABLE 12

OVERALL (TRAVEL TIME) SPEEDS FOR FOUR CLASSES OF ROAD, 1941-1971 (EXPRESSED IN MILES PER HOUR)

Type of Road	1941	1951	1961	1971
Four-Lane Divided Highway			48	54
Other Paved Highway	34	37	41	46
Gravel Road	24	26	28	30
Unimproved (earth) Road	20	20	20	20

Sources: Alberta Department of Highways: *Speed Study History Analysis*, unpublished printout, 1974.
Manitoba Department of Highways: *Annual Study--Speed Limits*, Winnipeg, 1971.
Matson, T. S. *et al*. *Traffic Engineering*, New York, McGraw-Hill, 1955, pp. 45-66.
Paustian, R. G. *Speed Regulation and Control on Rural Highways*, Highway Research Board Special Investigation, Washington, 1940, p. 23.
Pignatario, L. J. *Traffic Engineering: Theory and Practice*, Englewood Cliffs, Prentice-Hall, 1973, pp. 139-42.
Saskatchewan Department of Highways and Transportation: *Speeds on Saskatchewan Highways*, Regina, 1973, pp. 69-72.
United States Department of Transportation: *Highway Statistics Summary to 1965*, Washington, 1965, p. 50.

miles (derived from 1:250,000 topographic maps covering the area), and the number of minutes required to cover that distance in each of the years 1941, 1951, 1961 and 1971. To estimate travel time values for each link, information on road quality was garnered from official road maps published by the Government of Alberta. With the data coded for computer manipulation, it was possible to derive (a) the shortest mileage- and time-distances separating each place from any other, for each of the four dates, and (b) estimates of the degree of convergence (minutes saved per route mile) experienced by individual places over time.

SUMMARY

This chapter has fulfilled three primary functions: (a) the identification and definition of an area suited to the aims of the study; (b) the forwarding of a series of hypotheses relating to the issue of reorganization in a central place system and (c) the introduction of the data employed in testing these hypotheses. An area of some 9,100 square miles which focusses on Red Deer as its principal service centre was selected and its spatial bounds established. This region has an agricultural base, with a dispersed population served by a number of centres whose primary reason for being is that of providing surrounding populations with goods and services. The forms of reorganization that this system of places is expected to have undergone during the period 1941-71 were outlined. A series of hypotheses was proposed: these suggest that centres vie with each other for custom, the success of individual places in this competition being defined by their rates of growth and decline. Factors believed to play a part in the differentiation of the growth rates of central places were specified in the hypotheses. In measuring these rates of change, post office revenues were found to constitute an adequate surrogate for retail trade. While the primary emphasis is placed upon these revenues in the analysis which follows, some consideration is given also to the question of changes in the functions offered by central places in the region.

CHAPTER III

THE FORM OF REORGANIZATION

In this chapter the primary stress is on describing, at the regional level, the forms of reorganization undergone by the Red Deer central place system. Data relating to the functional makeup of service centres were assembled for each of the years 1941, 1951, 1961 and 1971 and provide the basis for the discussion. Manipulation of this information allows conclusions to be drawn on the structure of the central place hierarchy in the region, and on the types of activities found in the various orders of centres. Evidence is presented relating to changes which have occurred in the structural and distributional characteristics of the hierarchy since 1941, and a brief description of the system in a time-spatial context is undertaken.

CHARACTERISTICS OF THE HIERARCHY

The Determination of Hierarchical Form

The distribution of functional scores for each of the four years is illustrated in Figure 6 (for the lists of functional units from which the values were derived, see Appendix A; the values themselves are presented in Appendix B). It is immediately apparent from these graphs that the scores of places in the Red Deer region do not show pronounced tendencies to cluster around particular values in any of the years for which information has been collected. Some clear breaks in the arrays do occur, however, especially for 1941 and to a lesser extent for later

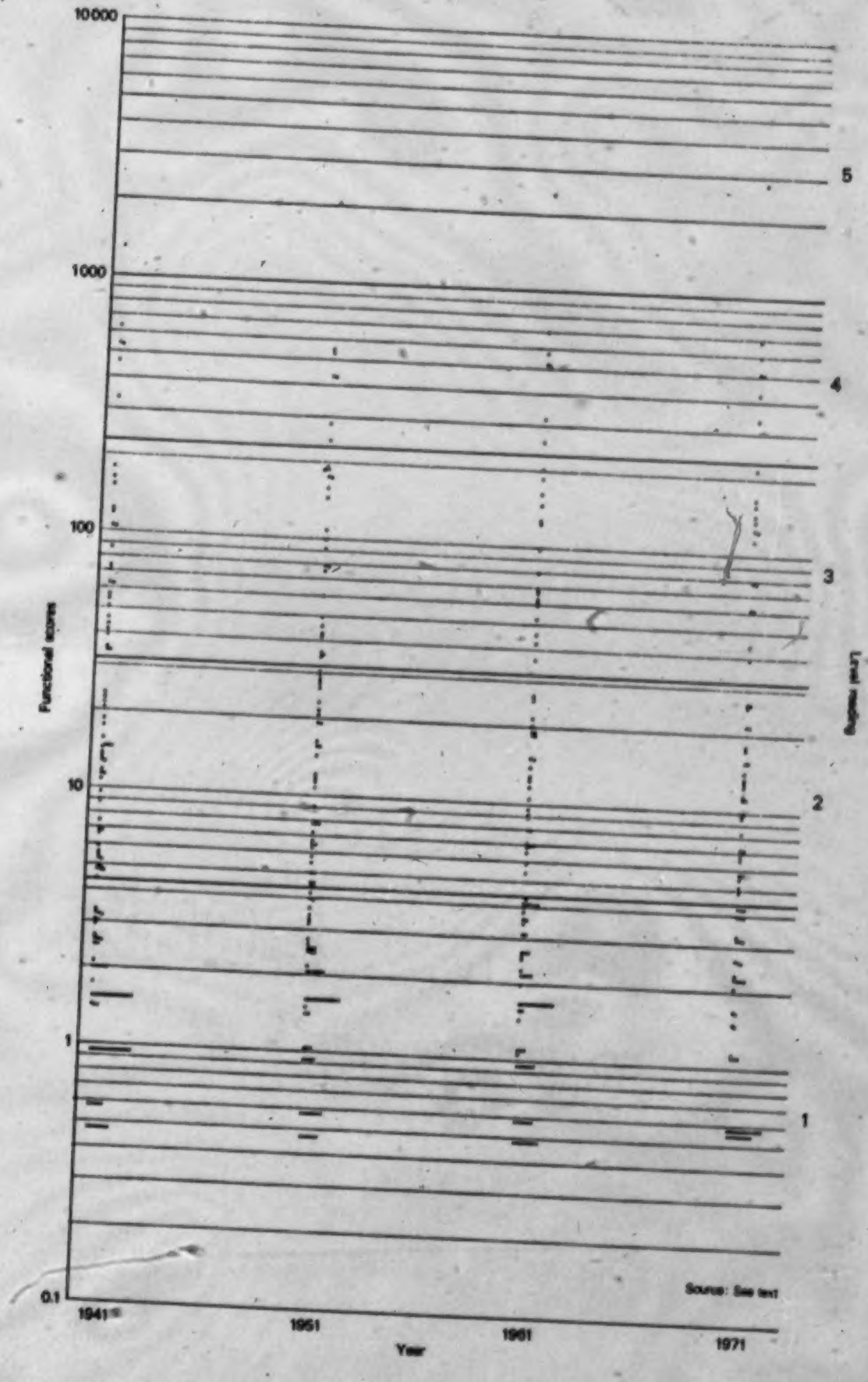


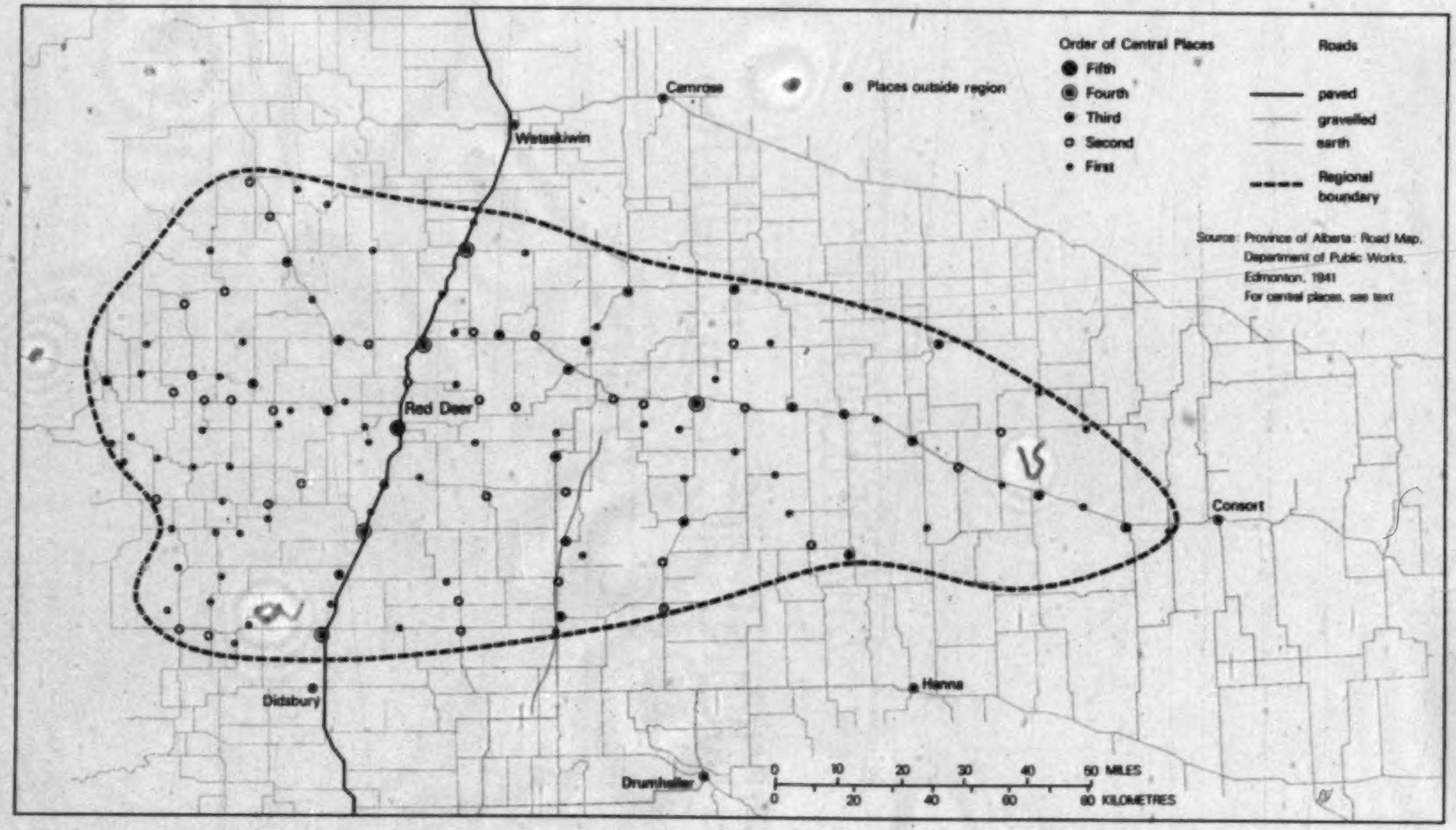
Figure 6 DISTRIBUTION OF FUNCTIONAL SCORES: CENTRAL PLACES IN THE RED DEER REGION, 1941-71

years, though these breaks do not always appear at the same locations. In all years, however, Red Deer itself is clearly distinguishable from other places and in fact appears to be increasing its primacy over the system. Other, less pronounced breaks occur at around values 230 and 32; moreover, these breaks appear in each of the four years in question. Among the lower scores the gaps in the distributions are less well defined and less consistent over time. A break between values three and five is apparent in both 1941 and 1961, however (major gaps occurring below a value of two were ignored since absolute differences in scores between places are miniscule here). Overall there is a striking similarity between the 1941 and 1971 arrays in terms of the locations of breaks, and for the most part these same breaks appeared in the intervening period. This tendency of gaps in the array to recur over time suggests a basic stability of form in the system and supports the conclusion that there were no more and no fewer levels in 1971 than in 1941. Accordingly the decision was made to consider the system as being made up of five loosely-grouped orders of centre divided by the most commonly-occurring gaps in the four arrays of scores. Discounting the highest order, which consists of only one centre (Red Deer) throughout, within-group differences in scores were in all cases greater than the differences between groups. This, however, is a common problem in empirical studies of systems of central places and one which can usually be overcome only by identifying an inordinate number of levels, often almost equal to the number of places involved (see, for example, Berry and Garrison, 1958). In any case the basic--if highly astringent--group test criterion (that each place be closer to another place of the same order than to any place of a different order) is satisfied by this division.

It will be noted that this method excludes consideration of the locations of central places in determining the form of the hierarchy. This deficiency is almost universal in the literature relating to systems of central places; a few writers have suggested that location as well as size of place should be incorporated into methods designed to test for the existence of hierarchies (for example, see Berry and Mayer, 1962, pp. 29-30), but satisfactory means of accomplishing this goal have proven elusive (Marshall, 1969, pp. 91-92). Nevertheless, when centres of the Red Deer region are mapped by rank determined by functional score alone, a distributional pattern exhibiting a high degree of symmetry does occur, at least for the three highest orders (Figures 7-10). The pattern does not, however, conform to any of those specified in central place theory. Centres of the fourth and fifth orders are concentrated along the Edmonton-Calgary corridor throughout the period, though from 1951 Stettler and Rocky Mountain House counterbalance each other as fourth-order places to the east and west of the corridor. Inspection of the maps suggests that symmetry of pattern declines when centres of lower order are considered, although third-order places do appear to become more regularly arranged over time with the emergence of Sundre in the southwest and the decline in the density of such centres north of a line joining Red Deer and Consort. Regardless of trends in spacing, however, the fact that a symmetrical spatial patterning of orders occurs does lend credibility to the decision to treat the centres as being hierarchically arranged, despite the fact that only very loose groupings are discernible on the basis of size alone.

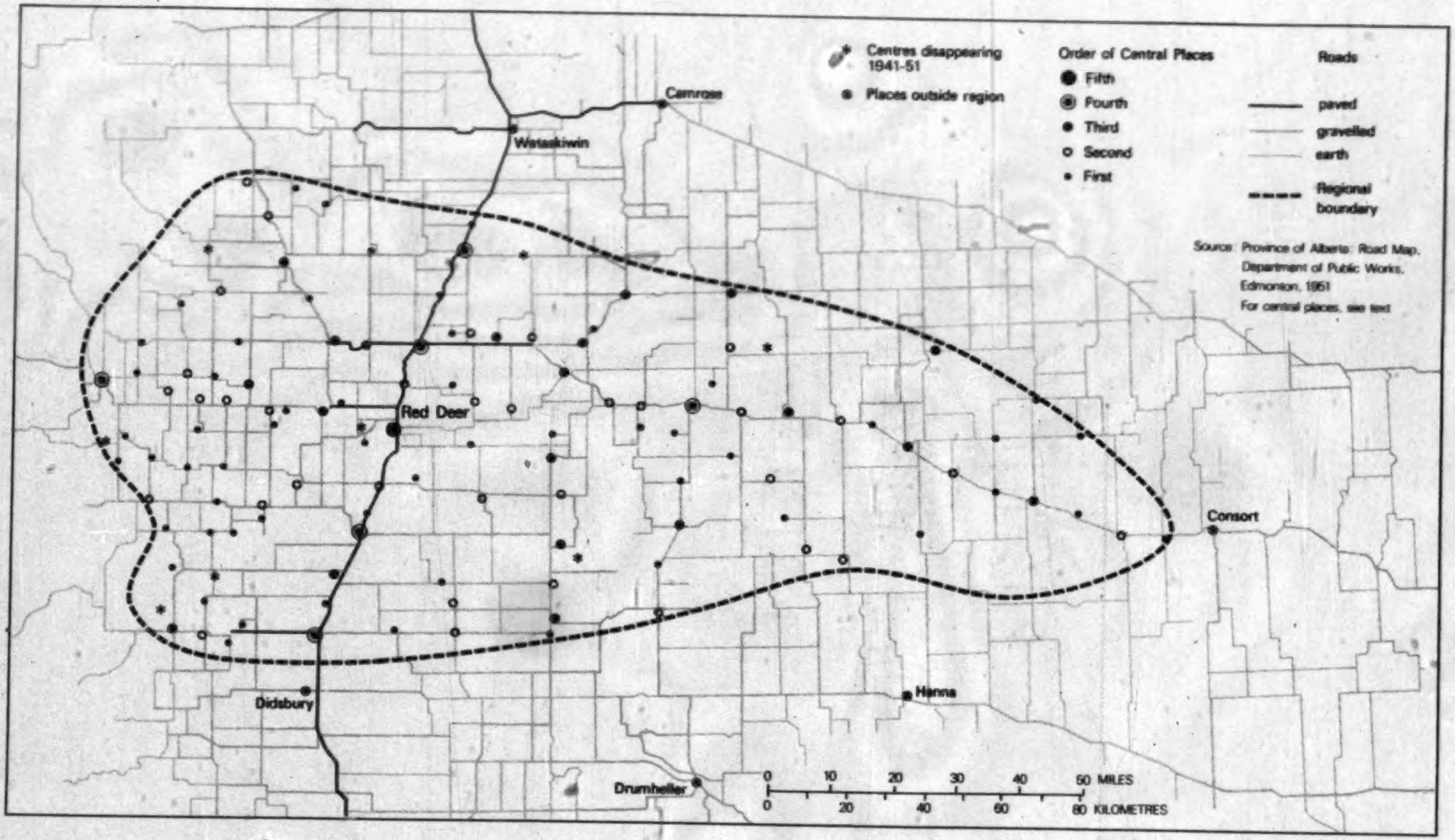
Functions and the Hierarchy

Central place theory stipulates that each member of a particular



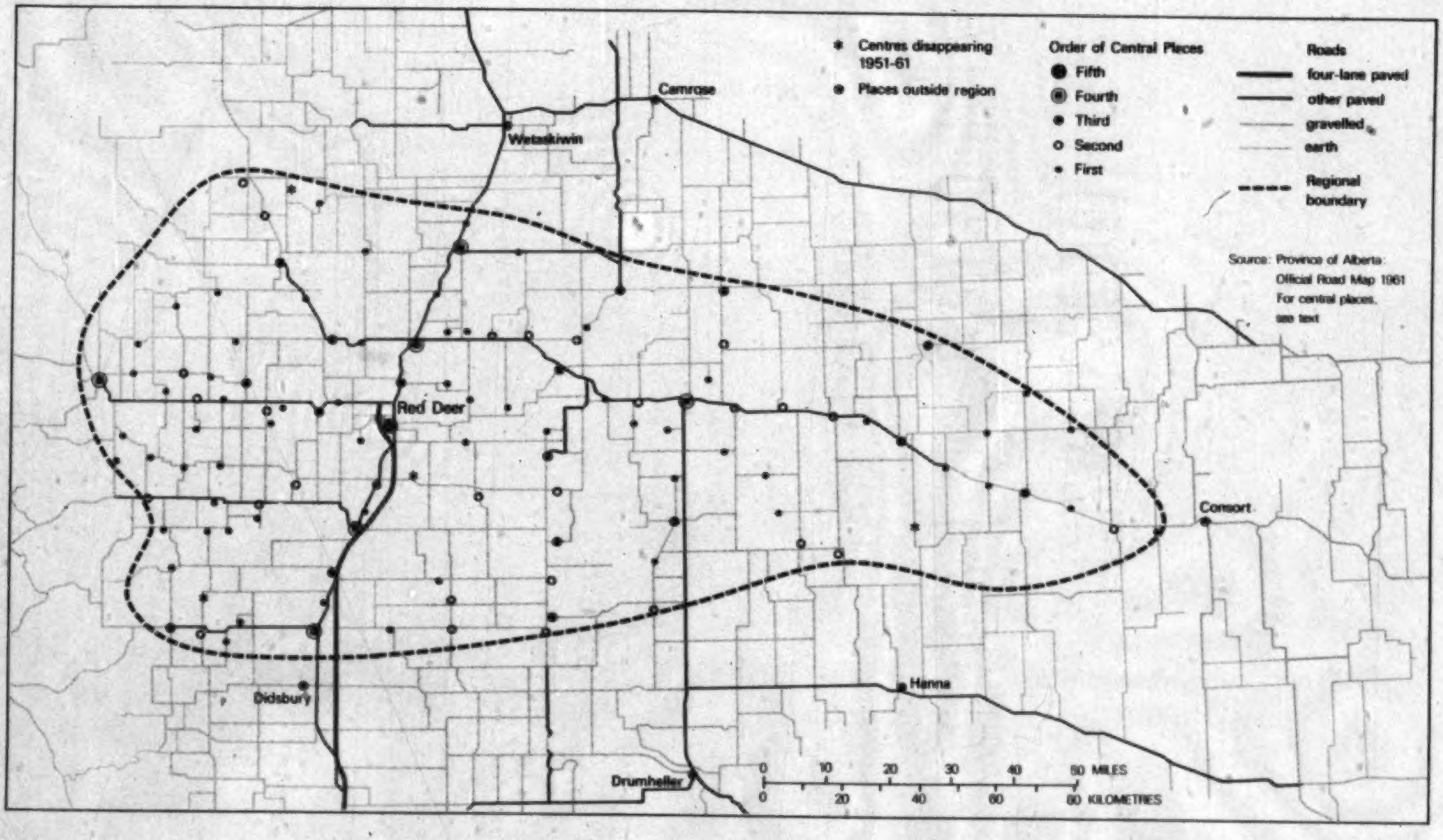
Source: Province of Alberta: Road Map, Department of Public Works, Edmonton, 1941
For central places, see text

Figure 7 THE CENTRAL PLACE SYSTEM OF THE RED DEER REGION, 1941



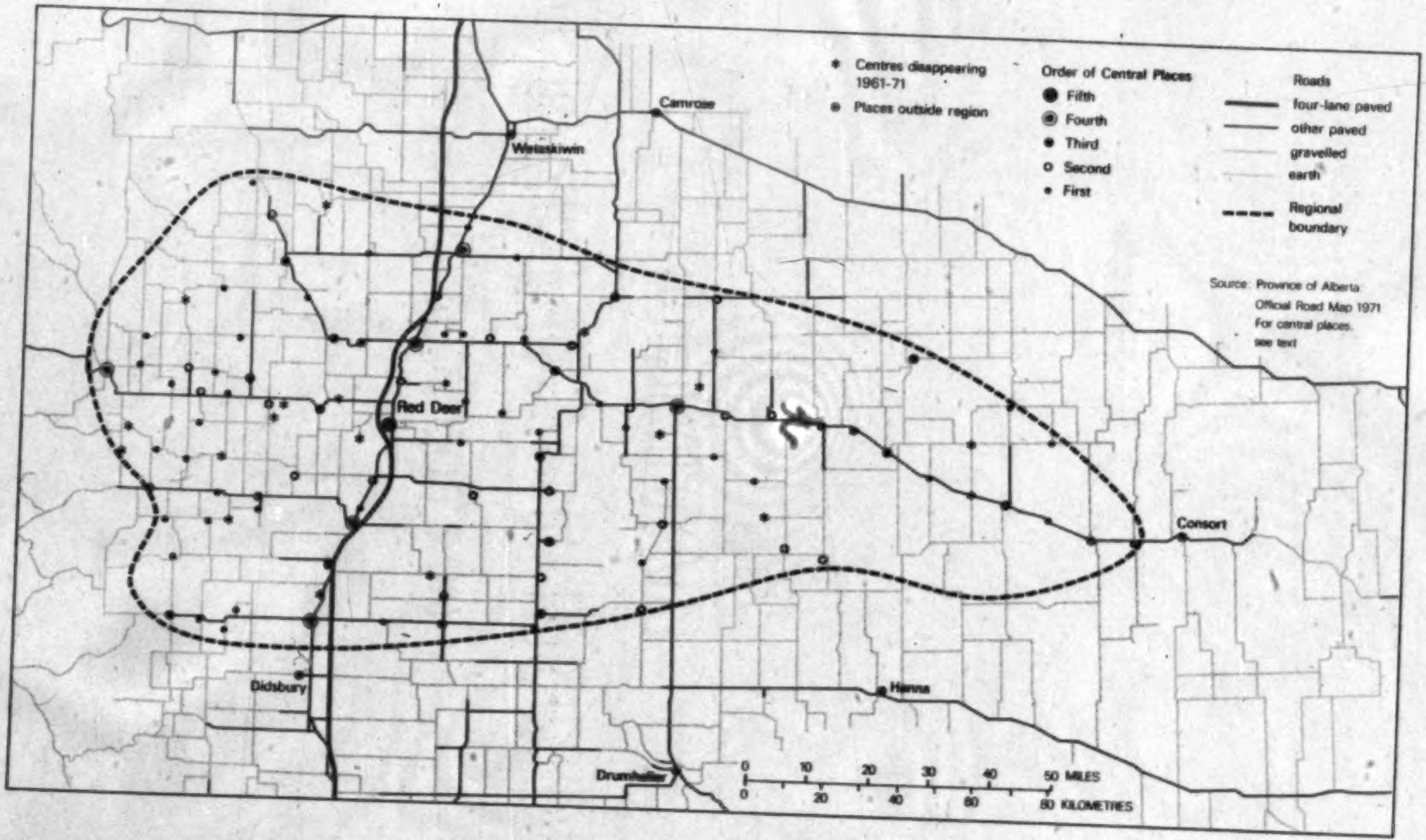
Source: Province of Alberta: Road Map, Department of Public Works, Edmonton, 1951
For central places, see text

Figure 8 THE CENTRAL PLACE SYSTEM OF THE RED DEER REGION, 1951



Source: Province of Alberta: Official Road Map 1961
For central places, see text

Figure 9 THE CENTRAL PLACE SYSTEM OF THE RED DEER REGION, 1961



Source: Province of Alberta Official Road Map 1971 For central places, see text

Figure 10 THE CENTRAL PLACE SYSTEM OF THE RED DEER REGION, 1971

class of centres offers a group of goods and services which is duplicated in centres of the next higher order, the latter also providing goods and services not offered in the class below (Christaller, 1966, p. 19; see also Berry and Pred, 1961, p. 15). In the real world some deviation from this rule is to be expected, since the hierarchical structuring of central place systems is invariably imperfect. In the Red Deer region, as an example, no function was common to all places in the lowest two classes of centre in any of the four years for which data were assembled. If the theoretical provision is relaxed, however, a general pattern closely resembling the expected one becomes apparent. With only a single exception, all functions which are present in at least three quarters of the centres of a particular level are also present in at least the same proportion of the centres of the next higher level. The exception is the absence of a menswear store in Red Deer in 1941. Since central activities often overlap in terms of the goods and services they provide, even this exception may be an illusion; men's clothing was probably obtainable in 1941 from Red Deer's department and family wear stores (see Appendix A, Table 1).

The types of functional activities occurring in three quarters or more of the centres of each of the five levels are detailed in Appendix D. It will be noted that successively higher levels of centre are associated with the appearance of successively higher order functions, the order of a particular function being defined by its location coefficient. For the lowest class of places, fourteen different functions occurred in at least one centre during the period (see Appendix C), but none was sufficiently widespread that it was ever offered in three quarters of the total. General stores, grain elevators and post offices make up the majority of the functional units found at this level, but few centres provide the services of all three and only general stores are found in more than half the centres in all four years. These same three functions are more nearly ubiquitous among centres of the second order, each occurring throughout the period in at least three-quarters of the places making up the class. Among third-order centres the basic automotive and farm service activities appear, along with hardware stores, restaurants and hotels. Most of the functions which occur regularly at this level but only infrequently among centres of lowest orders have location coefficients of between one and three. Among centres of the fourth order, the range of goods and services available is further increased. Stores offering clothing, appliances and furniture are virtually ubiquitous at this level throughout the period, as are the professional service establishments which occur infrequently at lower levels. Most of the functions whose appearance is diagnostic of the fourth order of places have location coefficients ranging between three and ten. Red Deer, apart from the exception noted above, consistently offers these same functions together with a range of more specialized goods and services. Throughout the period most of the latter have location coefficients of more than ten; in most instances in which a function occurs only once within the region it is to be found in Red Deer.

Each of the levels in the hierarchy of the region appears to be associated with a particular group of core functions the composition of which does not change greatly over time. Nevertheless some of the functions identified show signs of alteration in their patterns of occurrence within the hierarchy. Several activities appear to be undergoing centralization; that is, their function is disappearing from low order centres and becoming concentrated at higher levels in the hierarchy. Most of these activities were of low order at the beginning of the study period. The post office, a function which was virtually ubiquitous among central places in the region during the 1920s, shows signs of disappearing entirely from first order centres as a result of a policy being carried out by the Canada Post Office in which small and unprofitable units are being closed. Farm equipment dealerships, machine shops, general automotive repair garages, meat markets, grocery stores and pool rooms are disappearing from second-order centres and becoming concentrated in larger places. All these activities occurred in fewer centres in 1971 than in 1941 (see Table 6); in all cases their location coefficients increased during the period (Table 13). While these more basic functions were tending to show up-hierarchy movement, a number of functions with high coefficients in 1941 began to appear more often and in smaller centres thereafter. Examples here include beauty salons, appliance stores, insurance agencies, bookstores and the offices of accountants and optometrists. Similarly, some functions not present within the area at the beginning of the period were established first in Red Deer and later in centres of the fourth order. This down-hierarchy process of diffusion (see Berry, 1972; Pedersen, 1970) is no doubt partly the result of the general rise in disposable income which has permitted a reduction in the threshold populations necessary to support some types of central activity. In particular the evocation of diffusion processes appears to describe what is happening in the case of those expanding industries the products and services of which are increasingly penetrating the market place and becoming available to increasingly high

TABLE 13

LOCATION COEFFICIENTS OF CENTRAL FUNCTIONS IN THE STUDY AREA, 1941-1971

Type of Store or Service	Location Coefficient 1941	1951	1961	1971
Grain elevator	0.47	0.47	0.48	0.55
General store[a]	0.58	0.58	0.58	0.58
General automotive repair	0.74	0.69	0.83	0.90
Farm equipment	0.74	0.68	0.72	1.14
Machine shop	0.91	1.12	1.75	1.72
Post office	0.95	1.03	1.10	1.61
Restaurant	1.01	0.88	0.82	0.96
Service station	1.10	0.78	0.56	0.59
Bulk oil	1.37	1.11	0.85	0.99
Hardware	1.59	1.47	1.59	1.67
Meat market	1.72	1.85	2.44	3.33
Grocery	1.72	1.47	1.47	1.49
Building materials	2.22	1.75	1.69	2.17
Hotel	2.33	2.22	2.33	2.17
Automobile sales	2.33	1.18	1.22	1.61
Shoe repairs	2.44	3.23	6.67	14.29
Pool hall	2.50	2.86	3.33	9.09
Drug store	2.70	2.78	2.94	2.94
Physician	2.70	1.75	1.61	1.19
Bank	3.03	2.22	2.08	1.85
Law office	3.23	3.45	4.35	3.70
Creamery	3.57	4.17	4.00	5.88
Saddlery[a]	3.70	3.70		
Bakery	4.76	4.35	4.00	4.76
Jewellery	5.26	4.00	3.45	4.35
Beauty salon	5.26	3.45	2.63	1.43
Women's clothing	5.88	3.33	4.17	3.23
Household appliances	6.25	2.86	2.50	2.27
Insurance agency	6.67	1.45	1.11	0.85
Furniture	6.67	3.85	2.94	3.23
Less-than-daily newspaper	6.67	6.25	5.88	5.55
Funeral parlour	7.14	9.09	7.14	10.00
Men's clothing	7.69	5.55	4.17	3.57
General hospital	7.69	6.67	6.25	5.26
Electrical appliance repair	8.33	3.57	2.94	3.12
Farm supplies	9.09	5.26	3.85	2.86
Dentist	9.09	6.67	4.35	3.57
Tailor[a]	9.09	9.09	9.09	9.09
Dry cleaning	10.00	5.00	5.00	4.35
Shoe sales	12.50	11.11	9.09	7.14
Variety store	12.50	5.26	4.17	3.57
Dry goods	14.29	9.09	5.88	10.00
Automobile parts	14.29	5.88	4.76	2.78

TABLE 13 (Continued)

Type of Store or Service	Location Coeffient			
	1941	1951	1961	1971
Photographic studio	16.67	9.09	8.33	9.09
Chiropractor	20.00	12.50	12.50	5.88
Liquor sales	25.00	16.67	6.67	5.88
District agriculturalist	25.00	20.00	14.29	12.50
Specialized automotive repair	33.33	5.26	3.23	2.44
Public library	33.33	9.09	8.33	8.33
Family clothing	33.33	16.67	20.00	16.67
Confectionery	33.33	16.67	25.00	12.50
Accountant's office	50.00	9.09	6.67	4.17
Department store	50.00	20.00	10.00	5.88
Optometrist	50.00	20.00	11.11	6.25
Veterinary services	100.00	20.00	8.33	6.67
Children's clothing	100.00	20.00	9.09	25.00
Household furnishings	100.00	50.00	16.67	9.09
Florist	100.00	20.00	12.50	6.67
Book shop	100.00	50.00	14.29	11.11
Psychiatric hospital	100.00	50.00	50.00	50.00
Tertiary education	100.00	100.00	100.00	50.00
Fuel		33.33	20.00	7.14
Sporting goods		50.00	11.11	4.55
Motorcycles		50.00	50.00	14.29
Physiotherapist		50.00	50.00	16.67
Monuments		50.00	100.00	50.00
Upholstery repair		100.00	33.33	12.50
Music store		100.00	50.00	20.00
Nursing home		100.00	25.00	6.67
Auto rental		100.00	50.00	20.00
Trailer homes			12.50	9.09
Travel agency			100.00	33.33
Employment agency			100.00	50.00
Daily newspaper			100.00	100.00
Pet shop			100.00	100.00
Secretarial college			100.00	100.00
Equipment rental				16.67
Toy shop				50.00
Antiques				100.00
Camera shop				100.00
Health foods				100.00
Marriage counselling				100.00

[a] Treated as having 1941 coefficient throughout period (see text, p. 63).

Source: Appendix A (see also text, pp. 70-75).

proportions of society. The automotive functions and certain of the luxury- and recreation-oriented retail and service activities (including beauty salons, antique shops, travel agencies and sporting goods stores) are examples of these industries. A further agent of the process of decentralization has been the consolidation of governmental roles in the fields of social welfare and in some types of speciality retailing and service provision: the proliferation of nursing homes and liquor stores and the slower expansion in the numbers of district agriculturalists' offices and employment agencies are examples.

While several functions are undergoing a deconcentration of their patterns of occurrence within the hierarchy, their devolution has not for the most part proceeded beyond the two highest levels of places. All centres in levels four and five offered a wider range of goods and services in 1971 than in 1941; indeed the individual fourth-order centres in 1971 offered approximately as many different types of central function as had Red Deer thirty years previously (see Appendix E). A few functions began to appear more frequently in third-order centres during the period (the more specialized automotive functions, appliance stores, farm supply outlets, gift shops and liquor stores are examples), but centres at this level were also losing some functions (including lawyers' offices, funeral parlours, shoe repair businesses and drug stores) to larger centres as a result of centralization. With even more force the same can be said of second-order places: there has been a minor devolution of some of the basic automotive functions, but even these were becoming less numerous at this level during the 1960s. Overall, two patterns of change characterize the functions found in the central places of the region. The traditional activities of the lower order centres are gradually disappearing from these places and becoming more concentrated in larger centres, while new functions are being added to the arrays of goods and services offered in the more complex central places of higher order.

Estimation of Thresholds

A slightly different perspective regarding the behaviour of central functions over time may be derived from an analysis of the threshold sizes of centre at which activities enter the system. In measuring thresholds, previous researchers have defined size of centre using data on population size (Berry and Garrison, 1958; Brunn, 1967; Haggett and Gunawardena, 1964). Unfortunately most of the central places of the Red Deer region are unincorporated and for these centres no census data on size of population are available. Nevertheless, size of population was adopted in the following analysis in preference to functional score, since the latter has no meaning outside the particular regional context of this study.

Data relating to the populations of incorporated central places were obtained from the census for each of the years 1941, 1951, 1961 and 1971. In addition, estimates of the 1961 populations of unincorporated places were available from the Alberta Department of Municipal Affairs (1970). For each year, the centres were ranked by population (Table 14) and the presence or absence of particular functions was noted for each place. In most cases the resulting arrays were divisible at two points: one above which all places offered the function in question, and another below which the function did not occur. Between these points lay a transitional band of variable width in which the function occurred inconsistently. Within the band the median point of entry of the

TABLE 14

POPULATIONS OF CENTRAL PLACES, 1941-1971[a]

Central Place	Population 1941	1951	1961	1971
Red Deer	3,448	7,575	19,612	27,674
Ponoka	1,306	2,574	3,938	4,414
Stettler	1,295	2,442	3,638	4,168
Lacombe	1,603	2,277	3,029	3,436
Olds	1,337	1,617	2,433	3,376
Rocky Mountain House	800	1,147	2,360	2,968
Innisfail	1,223	1,417	2,270	2,474
Sylvan Lake	805	985	1,381	1,597
Rimbey	410	757	1,266	1,450
Castor	625	798	1,025	1,166
Coronation	581	738	864	877
Sundre		337	853	933
Trochu	480	630	671	739
Alix	360	461	631	565
Bashaw	494	603	614	757
Bentley	279	439	588	621
Eckville	135	379	580	660
Mirror	570	635	577	365
Blackfalds	113	154	477	904
Big Valley	291	307	461	306
Delburne	308	395	450	383
Bowden	234	277	437	560
Caroline			321	339
Penhold	183	174	319	452
Alliance	233	281	291	230
Donalda	206	318	289	232
Clive	224	241	251	247
Veteran	190	206	239	267
Elnora	195	211	214	213
Erskine	172		208	
Leslieville			178	
Halkirk	118	148	172	136
Benalto			147	
Torrington			130	118
Rumsey	90[b]	110	123	95[b]
Bluffton			115	
Botha	111	98[b]	112	99[b]
Huxley			102	
Byemoor			100	
Condor			99	
Gadsby	141	128	98	47[b]

TABLE 14 (Continued)

Central Place	Population 1941	1951	1961	1971
Red Willow			95	
Spruceview			85	
Wimborne			80	
Fleet			79	
Lousana			74	
Morningside			72	
Tees			63	
Westward Ho			51	
Nevis			45	
Endiang			40	
Gull Lake	21[b]	32[b]	40	57[b]
Markerville			40	
Alhambra			40	
Dickson			36	
Hoadley			35	
Brownfield			31	
Scollard			20	
Warden			20	
			20	

[a] Ranked by population in 1961.

[b] Not used in calculation of thresholds for functions.

Sources: Dominion Bureau of Statistics: Census of Canada, 1941, vol. 2 (Population: Local Subdivisions), Ottawa, 1944.
Dominion Bureau of Statistics: Census of Canada, 1951, vol. 1 (General Characteristics), Ottawa, 1953.
Dominion Bureau of Statistics: Census of Canada, 1961, ser. 1.1 (Geographical Distributions), Ottawa, 1962.
Statistics Canada: 1971 Census of Canada, vol. 1.1 (Geographical Distributions), Ottawa, 1973.
Alberta Department of Municipal Affairs: Population 3: Unincorporated Communities, Research Division, Provincial Planning Branch, 1970.

activity was defined as that population value at which the number of larger places not offering the function was equalled by the number of smaller places in which the function did occur (Marshall, 1969, pp. 97-100; see also Haggett and Gunawardena, 1964). In general this method appeared to provide a meaningful estimate of the threshold sizes of centre required for particular functions to enter the system. Some qualifications were necessitated, however. A few activities occurred sufficiently inconsistently with respect to size of centre that no meaningful threshold could be derived. In these cases the calculated value was ignored when less than half the centres above the value provided the function (see Marshall, 1969, p. 98). Secondly, a problem arises when attempts are made to estimate thresholds for certain high-order functions which appear only infrequently among even the larger centres. It is possible in such instances that the centres involved are part of a transitional band the upper limit of which is not known. To avoid giving misleading values on this account, no thresholds were calculated for functions which occurred in fewer than three centres. For some of the lower order functions, no precise measurement of threshold was possible since centres of less than one hundred people were ignored, except for 1961 when the acquisition of data relating to unincorporated places permitted the consideration of all places down to a minimum population of twenty. Finally, it should be noted that since the general tendency of the places listed in Table 14 is to increase in population over time, a function whose pattern of occurrence does not change will in general be accorded an increasing threshold. Some caution is therefore required in the interpretation of minor variations in the values shown in Table 15. Despite these deficiencies, the method appears to provide credible estimates of threshold for a majority of the functions identified. In any case the fact that little is known on the question of temporal variations in the thresholds of individual functions lends interest to the results. The concern here is primarily with the direction of change in the thresholds of central activities,

TABLE 15

ESTIMATED POPULATION THRESHOLDS OF FUNCTIONS, 1941-1971

Function	Estimated Population Threshold 1941	1951	1961	1971
Grain elevator	<100	<100	<20	<100
General store	<100	<100	<20	<100
General automotive repair	<100	<100	83	<100
Farm equipment	<100	<100	107	222
Machine shop	<100	<100	175	240
Post office	<100	<100	<20	<100
Restaurant	<100	<100	99	<100
Service station	<100	<100	38	<100
Bulk oil	<100	<100	68	<100
Hardware	<100	<100	139	175
Meat market	<100	<100	245	374
Grocery	<100	<100	139	231
Building materials	<100	<100	127	175
Hotel	<100	<100	119	<100
Automobile sales	229	164	320	374
Shoe repairs	127	226	762	3,172
Pool hall	<100	<100	270	1,050
Drug store	127	190	444	563
Physician	285	328	584	593
Bank	215	164	270	287
Law office	229	358	651	891
Creamery	201	279	379	700
Saddlery	187	1,517		
Bakery	257	358	601	748
Jewellery	487	532	601	748
Beauty salon	803	532	601	323
Women's clothing	487	617	623	891
Household appliances	576	417	584	641
Insurance agency	576	294	305	257
Furniture	532	633	859	817
Less-than-daily newspaper	374	417	584	593
Funeral parlour	445	687	762	[illegible],524
Men's clothing	803	633	762	817
General hospital	487	532	623	641
Electrical appliance repair	603	358	469	641
Farm supplies	803	417	579	323
Dentist	1,259	778	945	1,524
Tailor	603	1,-17	**	*
Dry cleaning	713	892	1,826	891
Shoe sales	1,259	1,517	1,826	1,524
Variety store	803	617	527	352
Dry goods	1,259	892	1,324	2,036
Automobile parts	1,259	892	1,146	748

TABLE 15 (Continued)

Function	Estimated Population Threshold 1941	1951	1961	1971
Photographic studio	1,301	1,066	945	1,524
Chiropractor	1,259	1,947	2,731	1,308
Liquor sales	1,301	1,282	651	700
District agriculturalist	1,301	1,517	1,826	2,036
Specialized automotive repair	*	748	945	891
Public library	1,322	687	945	919
Family clothing	**	1,282	**	**
Confectionery	**	1,282	**	2,721
Accountant's office	*	1,066	1,324	1,050
Department store	*	2,360	2,315	1,524
Optometrist	*	2,360	2,731	2,036
Veterinary services	*	1,947	945	919
Children's clothing	*	*	1,826	**
Household furnishings	*	*	*	3,802
Florist	*	1,947	2,400	2,036
Book shop	*	*	3,334	3,172
Psychiatric hospital	*	*	*	*
Tertiary education	*	*	*	*
Fuel		*	2,400	1,050
Sporting goods		*	2,315	891
Motorcycles		*	*	2,721
Physiotherapist		*	*	3,406
Monuments		*	*	*
Upholstery repair			3,334	3,406
Music store		*	*	3,802
Nursing home		*	**	1,050
Auto rental		*	*	*
Trailer homes			3,334	3,406
Travel agency			*	3,802
Employment agency			*	*
Daily newspaper			*	*
Pet shop			*	*
Secretarial college			*	*
Equipment rental				3,802
Toy shop				*
Antiques				*
Camera shop				*
Health foods				*
Marriage counselling				*

[*] Exists in fewer than three places.

[**] Fewer than half the centres above the calculated threshold have the function.

Source: Appendix A (see also text, pp. 70-75, and Table 14).

rather than with the values themselves.

Among the lower-order activities the tendency is almost universal for threshold populations to rise over time: indeed all functions with thresholds between 100 and 550 in 1941 experienced increases in threshold values over the ensuing thirty years. Similarly, several of the functions whose thresholds were below 100 in 1941 had shown increases in threshold by 1971. In most cases the degree of increase is sufficiently great to suggest a real tendency toward centralization in the pattern of occurrence. Among the higher-order functions no such consistency in the pattern of change is evident, though there does appear to be a weak tendency for thresholds to show an increasing propensity to fall as order of function increases. This finding accords with the discussion of the decentralization of high-order functions in the previous section.

A comparison of centrality coefficients with threshold values is instructive here. Several functions whose thresholds are increasing do not show a concomitant decline in frequency of occurrence within the region. Drug stores, for example, show little change over time in frequency of occurrence, but the threshold size of centre necessary to support the activity increases rapidly over time and indicates a progressive centralization on larger centres. Clearly, new units of this function are tending to be established only in the larger centres. Similarly, the frequency of occurrence of establishments providing women's clothing is increasing, but the threshold size of centre required to support such establishments is also increasing. Duplication of the function is apparently taking place in the larger centres. The same is true of banks, furniture stores and physicians (for further verification, see Appendix A). On the other hand, decentralization is characteristic of those functions which are tending both to occur more frequently within the system and to experience a decline in threshold. Beauty salons, insurance agencies, veterinary services and variety, sporting goods and liquor stores all show signs of being decentralized, though not as far as the very smallest centres. A few activities--menswear stores and the offices of dentists among them--showed slight tendencies toward decentralization early in the study period but in later years were subject to the reverse trend.

Overall, these results tend to confirm the conclusions reached earlier regarding changes in the occurrence of functions within the hierarchy. Most of the basic lower-order activities are apparently becoming unprofitable to operate from the smaller centres; with increases in the threshold populations necessary to support them, these functions are becoming centralized in the larger places. A second set of functions--primarily of intermediate or high order at the beginning of the period--are tending to decentralize as thresholds fall. Most functions of these orders, however, are characterized by erratic fluctuations in thresholds which may be a result of discrepancies introduced by the method of calculation. A clearer picture of trends in the behaviour of these activities is to be seen when centres are grouped by hierarchical levels (Appendix C) rather than treated as discrete cases ranked by size of population.

STRUCTURAL CHANGE, 1941-1971

The Hierarchy

During the period under examination the form of the central place hierarchy in the Red Deer region appears to have remained stable, the five levels maintaining relatively constant proportions of the total number of places (see Tables 16 and 17). When alterations to the status of individual places are considered, however, considerable change is apparent. Of the 125 centres extant in the area in 1941 (see Figure 4), thirty had disappeared by 1971, a further twenty-two had fallen to a lower class and only three had experienced shifts to a higher level

TABLE 16

NUMBERS OF CENTRAL PLACES PRESENT BY ORDER IN THE HIERARCHY, 1941-1971

Order	Year			
	1941	1951	1961	1971
1	61	56	63	46
2	36	35	27	28
3	22	19	17	14
4	5	6	6	6
5	1	1	1	1
Total	125	117	114	95

Source: Appendix B (see also Figure 6).

TABLE 17

CUMULATIVE PERCENTAGES OF CENTRES, BY ORDER IN THE HIERARCHY, 1941-1971

Order(s)	Year			
	1941	1951	1961	1971
1	49	48	55	48
1, 2	78	78	79	78
1, 2, 3	95	94	94	93
1, 2, 3, 4	99	99	99	99
1, 2, 3, 4, 5	100	100	100	100

Source: Appendix B

(Table 18; Figures 7-10). Those which fell to lower rank tended to have functional scores lower than the median for the class from which they originated. Of the ten smallest third-order places in 1941, for example,

TABLE 18

CHANGES IN NUMBERS OF PLACES EXISTING, BY ORDER IN THE HIERARCHY, 1941-1971

Order 1941	Number of Places	Dropout	Order 1971 1	2	3	4	5
1	61	28	32	1			
2	36	2	14	19	1		
3	22			8	13	1	
4	5					5	
5	1						1
	Total	30	46	28	14	6	1

Source: Appendix B

TABLE 19

ESTABLISHMENTS PRESENT IN CENTRAL PLACES, BY ORDER IN THE HIERARCHY, 1941-1971

Order	Year 1941 Number	%	1951 Number	%	1961 Number	%	1971 Number	%
1	100	5.9	99	5.0	121	5.8	84	3.8
2	299	17.8	324	16.3	263	12.5	248	11.3
3	680	40.4	673	33.9	635	30.3	573	26.1
4	457	27.1	636	32.0	725	34.5	807	36.8
5	148	8.8	254	12.8	354	16.9	483	22.0
Total	1,684	100.0	1,986	100.0	2,098	100.0	2,195	100.0

Source: Appendix E

seven had fallen to the second rank by 1971; only one of the twelve largest centres of this order did the same (see Appendix B). Net decline in numbers of places characterized the three lowest orders, among which the propensity of central places to decline or drop out from the system appears to increase toward the lower end of the size spectrum. Taken together, the two highest levels added only a single place during the period. The places comprising these orders, however, were attracting larger and larger proportions of the total number of establishments offering goods and services (Table 19). As noted above, it is these two orders which appear to be the foci of centralization in the Red Deer area.

The results presented in Tables 16-19 yield, for the most part, definite conclusions as to the types and degrees of change experienced by the central place system. Of interest, given the belief among some rural sociologists that few places actually disappear despite the centralization of trade (see, for example, Zimmerman and Moneo, 1971, p. 23), is the finding that a quarter of the places in existence in 1941 had dropped out by 1971 (Figures 8-10). The field survey carried out in the spring of 1974 (see above, pp. 74-75) ascertained that a further eleven had disappeared since that year (Appendix E). In the Red Deer region the tendency for established centres to disappear appears to date back at least to the 1920s. Excluding those nuclei which were physically relocated after initial formation, some twenty-seven places no longer in existence by 1941 operated post offices at some time during the 1920s (Canadian Almanac, annually). In North America the post office was traditionally among the first functions established in rural areas (Alwin, 1974; Shortridge, 1974), and in many cases its existence attracted other activities. In addition there were probably some locations which did not offer the services of a post office but which contained others of the basic central functions (Jensen, 1972). In any event, a minimum of 152 central places have existed in the region since 1920; of these some 45 per cent had disappeared by early 1974. As is true for the prairies in general, the centres which have disappeared were invariably small (see Fast, 1972, p. 18; Hodge, 1965b; Rees, 1974): indeed twenty-five of the forty places which dropped out of the Red Deer region after 1941 had only a single establishment in that year, and only two places had more than three establishments (see Appendix E).

Among the places still existing in the Red Deer region in 1971, several have experienced dramatic declines in terms of numbers of establishments operating and range of central activities present. Mirror, a third-order centre with twenty-two establishments in 1941, maintained only nine by 1971. Over the same period Gadsby experienced a net loss of fifteen of the twenty establishments present in 1941. In the longer run, the magnitude of decline has been even greater in some cases. During the 1920s Loyalist maintained a post office, five elevators and more than a dozen other business enterprises; by 1971 only two elevators remained (for the locations of these places, see Figure 4). In large measure, the decline of centres such as these appears to have been the result of the centralization of service activities in larger places. Comprehensive data on the locations of these activities have not been assembled for the period prior to 1941, but for some functions the record has been compiled by the authors of the Canadian Almanac. Between 1920 and 1930, some thirty-five places in the region operated banks; by 1941 the function was present in only twenty-two. The publication of local newspapers was carried out in twenty-five places during the 1920s; only fifteen still supported such enterprises by 1941. Again, it was the smaller places rather than the larger which tended to lose these activities.

A second finding relates to the suggestion of Hodge (1965b) and Stabler (1973) that the hierarchical form of central place systems is becoming simplified over time, with numbers of centres increasing at both ends of the hierarchy and decreasing in the middle ranks. There is a problem here in comparing the results of studies in which different hierarchical structures have been identified, but the orders which Hodge and Stabler have noted as being subject to net losses of places appear to correspond fairly closely with the second and third orders defined for the Red Deer region. Between 1941 and 1961 these two ranks were the only orders to experience net losses, the lowest rank approximately balancing numbers of centres gained from above and numbers lost through demise. After 1961, however, the growing propensity of the smallest places to drop out of the system appears to have negated the trend toward hierarchical simplification (see Tables 16 and 17). It is apparent, however, that the tendency for places to decline in numbers of establishments has been increasingly felt at progressively higher levels in the hierarchy. Decline or lack of growth has characterized centres of the two lowest orders throughout the period, but during the 1950s a majority of the third-order centres present in 1951 also showed declines in numbers of operating establishments (Table 20, see also Appendix E). This tendency was solidified during the 1960s, in which period some of the centres of the fourth order also showed signs of retrenchment. To the extent that net change in numbers of establishments illustrates entrepreneurs' assessments of the viability of a central place, it would appear that centres in the three lowest orders are, with few exceptions, unviable. Some of the larger third-order places showed

TABLE 20

CHANGE IN NUMBERS OF ESTABLISHMENTS IN CENTRAL PLACES, BY ORDER IN THE HIERARCHY AND DECADE

Order	Decade Beginning	Number of Centres	Growth	No Change	Decline	Dropout
1	1941	61	4	44	5	8
	1951	56	1	41	10	4
	1961	63	0	30	14	19
2	1941	36	12	8	16	0
	1951	35	4	7	24	0
	1961	27	3	5	19	0
3	1941	22	16	1	5	0
	1951	19	8	1	10	0
	1961	17	5	1	11	0
4	1941	5	5	0	0	0
	1951	6	6	0	0	0
	1961	6	5	0	1	0
5	1941	1	1	0	0	0
	1951	1	1	0	0	0
	1961	1	1	0	0	0

Source: Appendix E

marginal increases in numbers of operating establishments after 1961, but none appears likely to rank with the fourth-order centres in the near future and some which are not growing may fall to the next lower level in the hierarchy. Centres of the fourth rank may be entering a period of relative stability in their levels of service provision, leaving only Red Deer to show continued growth.

The Spacing of Centres

In this section, changes in the distributional characteristics of the central place system are considered. As noted in Chapter II, a formal analysis of pattern is not attempted; instead the focus is on the distances (measured on the road network and expressed in both miles and travel time) separating near neighbours. It has been shown above (pp. 103-04) that centres of a particular level provide basically the same goods and services offered by places of lower order in addition to a number of goods and services not provided at lower levels. Therefore, the analysis of the spacing of centres which offer the most basic of functions considers all places in the region rather than the first-order places alone; discussion of the spacing of places offering the goods and services provided by second-order centres considers all places of the second and higher orders (see also Hodge and Paris, 1967).

Previous research has suggested that the distribution of central places offering particular levels of service tends to become more regular over time, at least when the distances separating near neighbours are measured in Euclidean space (for example, see Kariel, 1970). From a normative viewpoint, increasing regularity may be regarded as a concomitant of the processes by which systems of places "select" certain centres to shift between orders on the basis of their locations relative to competing centres (see above, pp. 24-26 and Lukermann, 1966, p. 43). It is not clear, however, that the same expectation should hold when the spatial separation of places is measured in non-Euclidean and relative space. Particularly this is the case with the realm of time-space. Since the time-spatial relationships of places are almost continually undergoing alteration, the process of selection is likely to be complex and difficult to predict. To the writer's knowledge, no empirical analyses have been carried out on the question of whether the degree of regularity in the time-spatial distances separating near neighbours tends to increase or decrease. Such analyses would be difficult if not impossible to achieve using the traditional geographical methods of testing for the presence or absence of spatial regularity, given that plane maps cannot be constructed in which all time-spatial relationships existing among a set of points are faithfully preserved (see Tobler, 1963, p. 75).

In order to describe changes in the spacing of centres, the distances separating each place from its nearest neighbour of the relevant class were arrayed. Simple descriptive statistics were calculated for these arrays so that conclusions could be drawn regarding trends in spacing over time. The arithmetic mean was employed to indicate whether mileage and travel-time distances between near neighbours were increasing or decreasing during the period since 1941. To test for trends in the dispersion of values around the mean, the standard deviation applicable to a particular array was divided by the relevant mean to give the coefficient of variation (V). Use of this coefficient allows degrees of dispersion in values to be compared under conditions of varying means. A reduction in the magnitude of the coefficient over time can be taken as indicating a trend toward increasing regularity in the distribution of central places.

Tables 21 and 22 summarize the results of the analysis. When distances are measured in miles (Table 21), mean spacing between near neighbours increases with order of goods and services supplied, as is predicted by central place theory. In addition, spacing tends to increase over time for all classes of place. For the three lowest classes this is to be expected, other things being equal, since the number of centres involved is decreasing in a constant area. The increase in mean distance for the highest class (comprising centres of the fourth and fifth orders) results from the addition after 1941 of a single place a long distance from its nearest neighbour of equivalent or higher order (the centre is Rocky Mountain House: see Figures 7 and 8).

TABLE 21

SPACING CHARACTERISTICS: MILEAGE DISTANCES, 1941-1971

Order of Place	Order of Nearest Neighbour	Year	Number of Cases	Mean Distance to Neighbour (miles)	Coefficient of Variation (V)
1, 2, 3, 4, 5	1, 2, 3, 4, 5	1941	125	6.50	0.058
		1951	117	6.50	0.060
		1961	114	6.54	0.061
		1971	95	7.13	0.088
2, 3, 4, 5	2, 3, 4, 5	1941	64	8.27	0.128
		1951	61	8.74	0.133
		1961	51	9.35	0.098
		1971	49	9.82	0.102
3, 4, 5	3, 4, 5	1941	28	14.18	0.163
		1951	26	15.46	0.214
		1961	24	15.96	0.210
		1971	21	16.81	0.207
4, 5	4, 5	1941	6	22.00	*
		1951	7	26.00	*
		1961	7	26.00	*
		1971	7	26.00	*

*Not calculated because of small number of cases involved.

Source: see text, p. 124 and Appendix B.

While it is apparent that the reduction in the numbers of places at the lower and intermediate levels of the hierarchy is associated with general increases in spacing, there is no evidence that greater regularity of spacing is occurring. No definite conclusion emerges from inspection of the coefficients of variation. The statistic was not calculated for the highest class of centres, but for the remaining classes no consistent trend was evident. For one class the behaviour of the coefficient was erratic; for the remaining two an increase in dispersion was indicated but the degree of increase was so slight as to be considered insignificant. In any case the small magnitude of the coefficients and the standard deviations from which they were derived suggests that a high degree of regularity in spacing is characteristic throughout the period.

TABLE 22

SPACING CHARACTERISTICS: TIME DISTANCES, 1941-1971

Order of Place	Order of Nearest Neighbour	Year	Number of Cases	Mean Distance to Neighbour (minutes)	Coefficient of Variation (V)
1, 2, 3, 4, 5	1, 2, 3, 4, 5	1941	125	18.42	0.050
		1951	117	15.73	0.037
		1961	114	12.67	0.054
		1971	95	11.45	0.048
2, 3, 4, 5	2, 3, 4, 5	1941	64	22.13	0.125
		1951	61	19.72	0.124
		1961	51	16.80	0.084
		1971	49	14.47	0.102
3, 4, 5	3, 4, 5	1941	28	37.00	0.180
		1951	26	33.77	0.223
		1961	24	28.00	0.166
		1971	21	23.67	0.189
4, 5	4, 5	1941	6	45.50	*
		1951	7	49.00	*
		1961	7	37.00	*
		1971	7	33.86	*

*Not calculated because of small number of cases involved.

Source: see text, p. 124 and Appendix B.

A similar conclusion on the question of variability in spacing was reached when distances were expressed in terms of travel time (Table 22). Again an increase in mean spacing with order of service provision is discernible, but within classes of centre there is a clear reduction over time in the degree of separation between neighbours. Apparently, the convergence of centres in time-space more than offsets the fact that neighbours are tending to become more widely separated in terms of miles. For each class, mean time-distances in 1971 are about two-thirds of the corresponding values for 1941. Interestingly enough, centres providing a particular set of goods and services were, on average, closer together in 1971 than were centres offering the next lower group of functions (Appendix D) thirty years previously.

Routeway Upgrading, Time-Space Convergence and the Density of Centres

A somewhat different perspective on the spacing of central places is achieved when the time-spatial shrinkage of the entire region is considered. The road network has been greatly upgraded since 1941, both by improvements to surfaces and through the creation of new, more direct and higher-quality links. At the beginning of the period, the only paved highway traversing the region was that linking Edmonton and Calgary and running through Red Deer (Figure 7). Since 1941 a four-lane divided highway has been constructed along this corridor. Other, less significant additions have included the construction of a new link between Stettler and Drumheller and a number of minor route changes involving the straightening of roads and the bypassing of small centres. The latter, however, are of insufficient scale to be shown on the accompanying maps. Throughout the region the quality of roading surfaces has improved: all the gravel roads of 1941 have been paved and most of the unimproved surfaces have been gravelled or in some cases paved.

Since 1941, improvements to the quality of the network have been so located as to connect first the larger and later the smaller places with upgraded facilities. Assuming that volumes of traffic are greatest between large centres, the links between such centres will be those on which the greatest demand for structural improvement is manifested (Janelle, 1969, p. 357; see also Hall, 1966). Thus by 1961 all fourth-order places were served by paved roads; in that year two-fifths of the third-order places were located on surfaces of lower quality and the proportion was higher for centres of still lower order. By 1971 all but one of the third-order places were on paved roads, but nearly half the centres of the two lower ranks were not connected to the system of hardtop surfaces (Table 23). Those lower-order places which were early served by paved and gravelled roads were invariably located on direct links between larger centres.

The fact that the larger places are the first to benefit from the construction of roads of a higher quality than those already existing is analogous to the case of the hierarchical diffusion of innovations. Janelle (1974, p. 265) has noted that improvements to the transportation network, since they first link the major places of a system, tend to reinforce the dominance of such centres over their smaller rivals. Similarly, the initial adoption of new telecommunications technologies in large cities enhances their domination over lower-order centres which tend to adopt later (Clark, 1974, p. 181). Notably, none of the fourth- and fifth-order centres of the Red Deer system have declined in rank or experienced net losses of establishments over the period since 1941.

TABLE 23

HIGHEST QUALITY OF ROAD SURFACE ON WHICH PLACES OCCUR, BY ORDER IN THE HIERARCHY, 1941-1971

Order	Type of Road Surface	Year			
		1941	1951	1961	1971
1	Earth	53	25	9	2
	Gravelled	5	26	40	26
	Paved	3	5	14	18
2	Earth	22	3	0	0
	Gravelled	11	28	15	6
	Paved	3	4	12	22
3	Earth	9	0	0	0
	Gravelled	12	16	7	1
	Paved	1	13	10	13
4	Earth	0	0	0	0
	Gravelled	1	2	0	0
	Paved	4	4	6	6
5	Earth	0	0	0	0
	Gravelled	0	0	0	0
	Paved	1	1	1	1

Source: Official Road Maps, Province of Alberta; 1941, 1951, 1961, 1971.

Because it closely reflects the distribution of the higher-order centres, the spatial pattern of highway improvements is instructive. Ever since the Edmonton-Calgary highway was paved during the 1930s, paving programmes within the Red Deer region have concentrated heavily on those east-west links emanating from the fourth- and fifth-order centres located along the corridor. In all likelihood this directional bias in the focus of the higher-quality roads has intensified the dominant east-west pattern of consumer movement which originated when the first centres developed along the Edmonton-Calgary axis. These centres had the advantages of an early start and most grew to the status of towns early in the twentieth century. The concentration of high-order places along the corridor is presumably a legacy of the spatio-temporal pattern of settlement (see MacGregor, 1972, pp. 196-202), later reflected in the upgrading of roads emanating outwards from the corridor and in higher rates of growth along the major highway than elsewhere in the province (on the latter point, see Barr, 1972; Leigh and Carter, 1972). With few exceptions, the paving of north-south routes to the east and west of the corridor began only after 1961 and as yet has probably not proceeded far enough to greatly influence patterns of trip behaviour (compare Figures 9 and 10).

An impression of the impact of the shrinkage of space on the density of service centres can be obtained simply by mapping the area in time-space. Perfect accuracy in such mapping is difficult to achieve, but an approximation may be obtained by constructing a cartogram in which lines proportional in length to driving time are drawn from some central point within the region to a series of points on the periphery. If the latter are then joined by straight lines (the assumption being made that errors of over- and under-estimation counterbalance each other), the approximate time-spatial "area" of the region can be calculated. In the present case, thirteen radial lines centred on Red Deer were drawn, and the time-distance boundaries of the region were demarcated for each year. Calculation of the areas of the resulting triangles gives an approximation of the size of the region in time-spatial terms (Figure 11). The impression given by this cartogram is that the region was greatly diminished in size over the study period; in fact, its "area" in 1971 was only three-tenths that of 1941. Degree of shrinkage has varied little by decade within the period, although

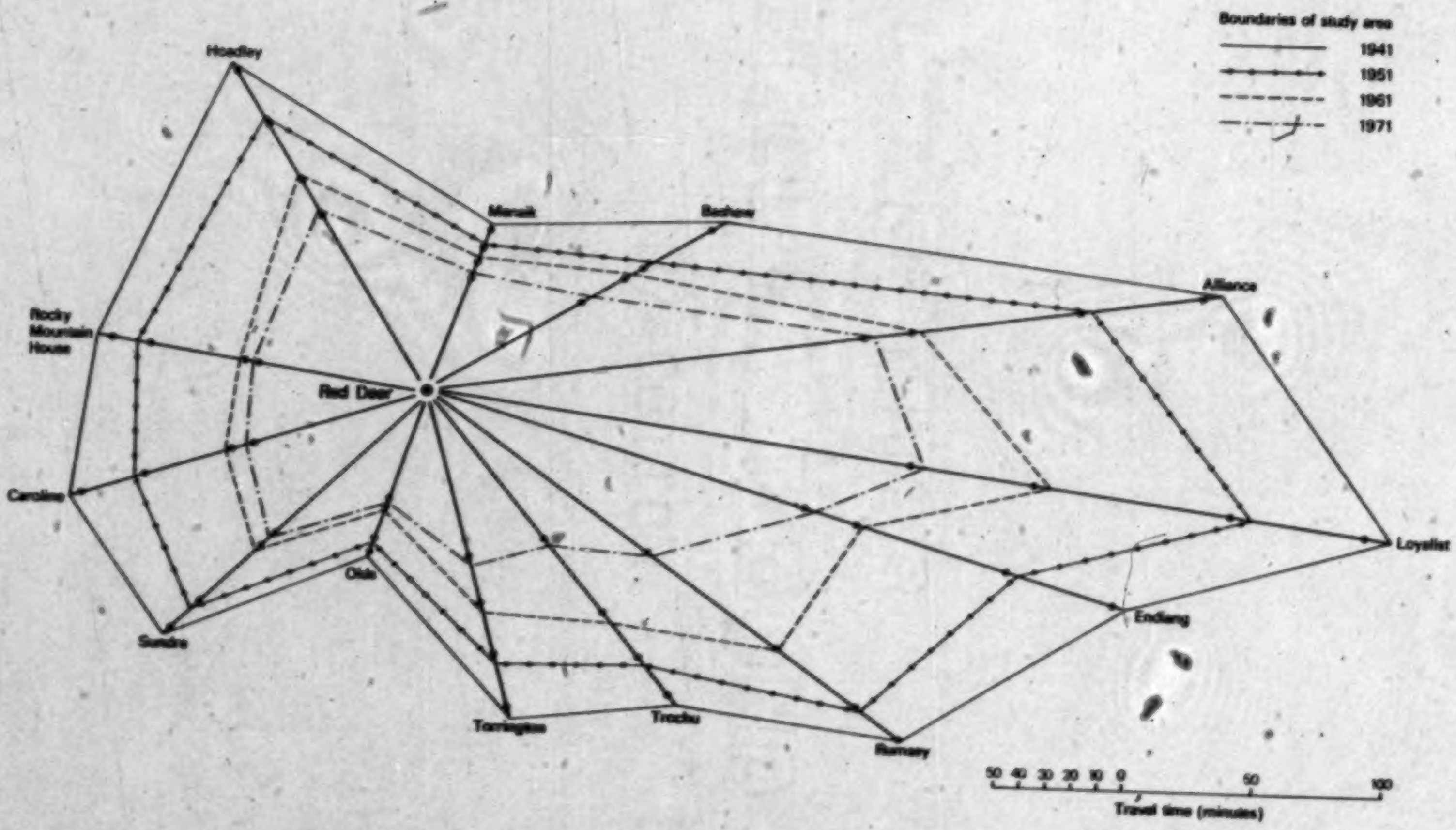


Figure 11 SHORTEST TIME - DISTANCE FROM RED DEER TO SELECTED POINTS ON THE PERIPHERY OF THE STUDY AREA, 1941-1971

it appears to have reached a peak during the 1950s (see above, p. 40 and Table 24).

TABLE 24

THE SHRINKAGE OF THE RED DEER REGION, 1941-1971

Year	Percentage of 1941 Area	Percentage of Area a Decade Previously
1941	100.0	-
1951	73.9	73.9
1961	44.0	59.5
1971	30.0	68.1

Source: Figure 11.

Given that the functional size of the region has decreased by 70 per cent, it follows that a similar decline in number of centres would be required for the 1941 density of central places to be maintained. In fact, the number of places has declined by only a quarter. For other regions of Canada it has also been suggested that the "thinning out" of trade centres in recent decades has been slight given the degree of improvement in travel times (see Hodge, 1965c, p. 16). As elsewhere, therefore, trade centres in the Red Deer region are now more accessible to consumers than was formerly the case. Moreover, this is the case for the centres of all five ranks. Degree of increase in accessibility is highest for orders four and five: all other ranks have experienced net losses in numbers of centres, though the losses are insufficient to offset the impact of convergence upon densities. In particular, then, people are better served as regards the accessibility of the higher-order places. Table 25 lists the number of places occurring at each level during the period, and the number which would

TABLE 25

OBSERVED AND EXPECTED NUMBERS OF CENTRAL PLACES, BY ORDER IN THE HIERARCHY, 1941-1971

Order	1941	1951		1961		1971	
	Observed	Observed	Expected	Observed	Expected	Observed	Expected
1	61	56	46	63	27	46	18
2	36	35	27	27	16	28	11
3	22	19	16	17	10	14	7
4, 5	6	7	4	7	3	7	2

Sources: Table 16, Figure 11.

have occurred assuming constant hierarchical structure and the density of centres in time-space remaining unchanged over time at 1941 levels. Density has not declined in proportion to the degree of time-spatial shrinkage of the region. Lag times in the adjustment of the system are considerable: interestingly enough, the "expected" 1951 frequency for the lowest two orders of the hierarchy is achieved almost exactly by 1971. To an undetermined degree the slow rate of change suggests the presence of inertia, but it should be noted that consumers were much better served in terms of the accessibility of central places in 1971 as compared with 1941.

SUMMARY

The Red Deer system of central places has undergone reorganization in a number of ways since 1941. A loosely-structured hierarchy, the existence of which becomes apparent when centres are mapped by size class, was nevertheless shown to have maintained a stability of form throughout the period despite much shuffling of centres between ranks. These different orders of centre are each associated with a group of central activities. In general, each order offers the goods and services supplied by places of lower rank, in addition to an incremental group of goods and services not provided by the smaller centres. The functional offerings of the various orders of place remained fairly stable over time, although there was evidence that the threshold population sizes at which central activities entered the system were being altered for some functions. Lower-order functions (those which occur frequently and have low thresholds of entry) were undergoing centralization and were gradually disappearing from the smallest places. Some of the less frequently occurring functions, which in some cases were not found even in Red Deer in 1941, later appeared in that centre and were devolved to centres of the fourth order during the period. Both these processes of change were set in train before 1941. A quarter of the centres in existence in that year had disappeared by 1971, and if this trend were continued the virtual disappearance of the lowest two orders of central places would occur. Centres of higher order appear more viable, though several are now stagnating and even losing functions. Red Deer's primacy over the system is increasing.

On the question of the spacing of centres, it was shown that nearest neighbours offering particular levels of goods and services are becoming more distant from each other when their separation is measured by the shortest-mileage path along the road network. Because of the shrinkage of space brought about by improved roads and faster vehicles, however, the separation of places in time-space is decreasing. When distances such as these are measured on the road network, there is no evidence to suggest that the distributional pattern of trade centres is becoming more or less regular. The density of centres in time-space is increasing, however, and customers are now in effect closer to a larger number of market alternatives than formerly they were.

CHAPTER IV

EXPLANATION OF REORGANIZATION

In this chapter the focus shifts from the system as a whole to the growth behaviour of the central places themselves. Growth and decline are measured using the standardized gross revenues of post offices for each of the four control dates between 1941 and 1971 (see above, pp. 80-87). Since not all central places in the Red Deer region operated post offices during the period, the analyses which follow are based on universes of places smaller in number than those examined in the previous chapter. For all years, however, it is only centres of the two lowest orders which in some cases lack the function; all centres of the three highest ranks operated a post office throughout the period (for the locations of places which have operated an office at any time since 1941, see Figure 12). All calculations relating to the growth and decline of central places over a specified period include only those centres which maintained a post office throughout that period, places in which the post office was closed being ignored. Figures 13-16 utilize a simple three-part division in classifying centres by rate and direction of change in revenue: absolute decline (loss of revenue), relative decline (increase slower than that for the region as a whole) and relative growth (increase faster than that of the region). Given the deficiencies inherent in the method adopted to standardize post office revenues (see above, pp. 80-87), this simple division serves to minimize the danger of

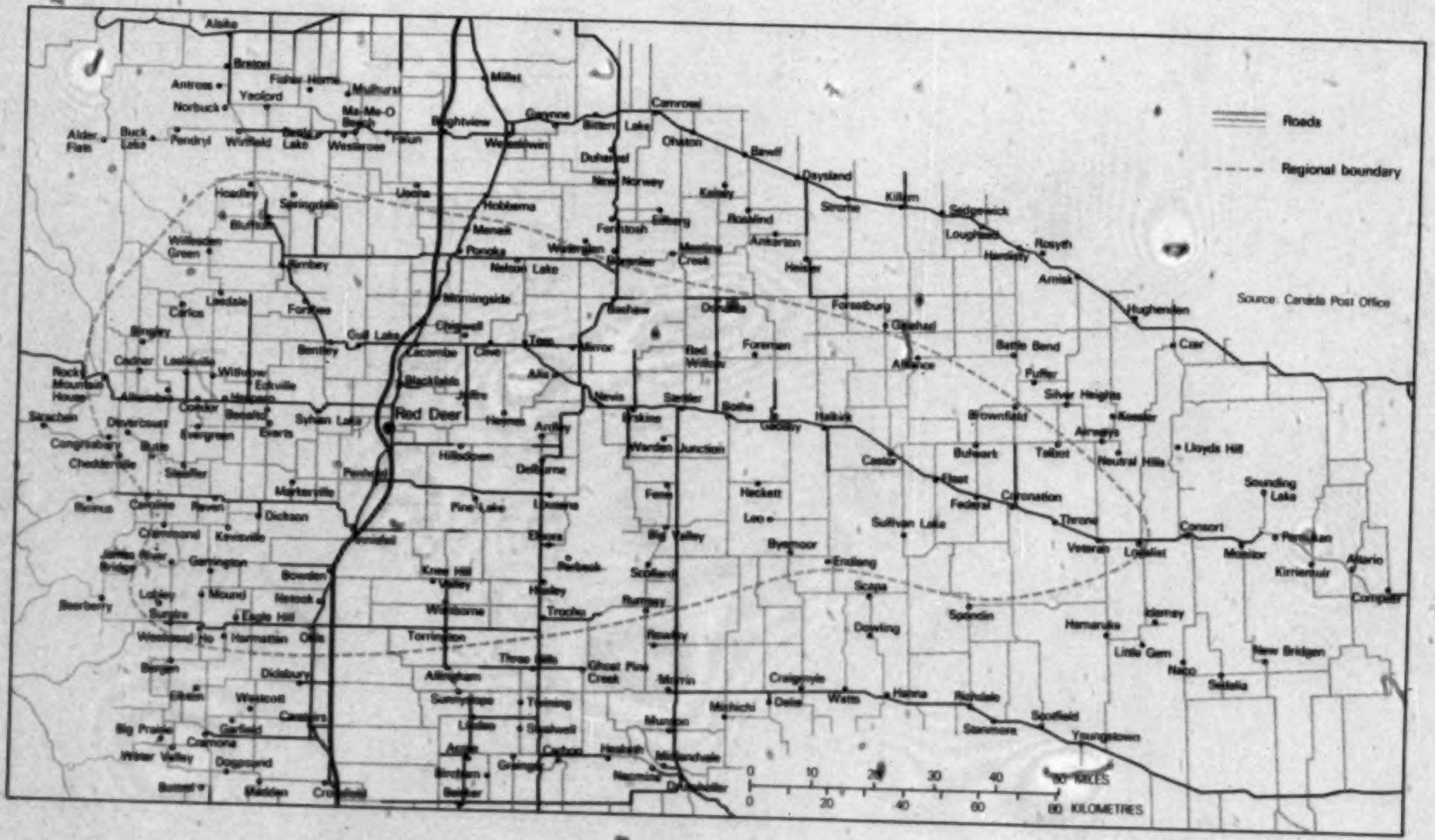
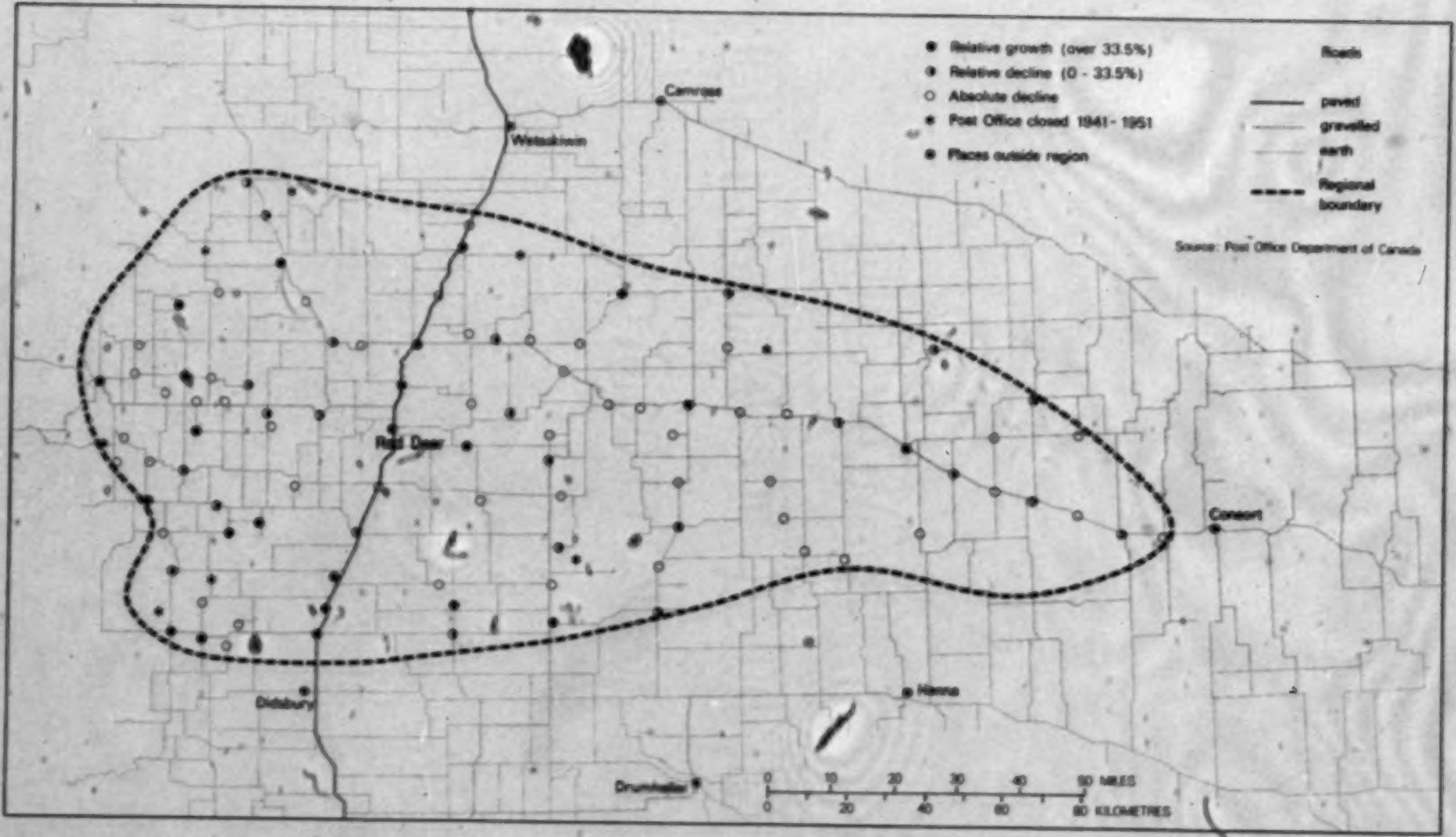
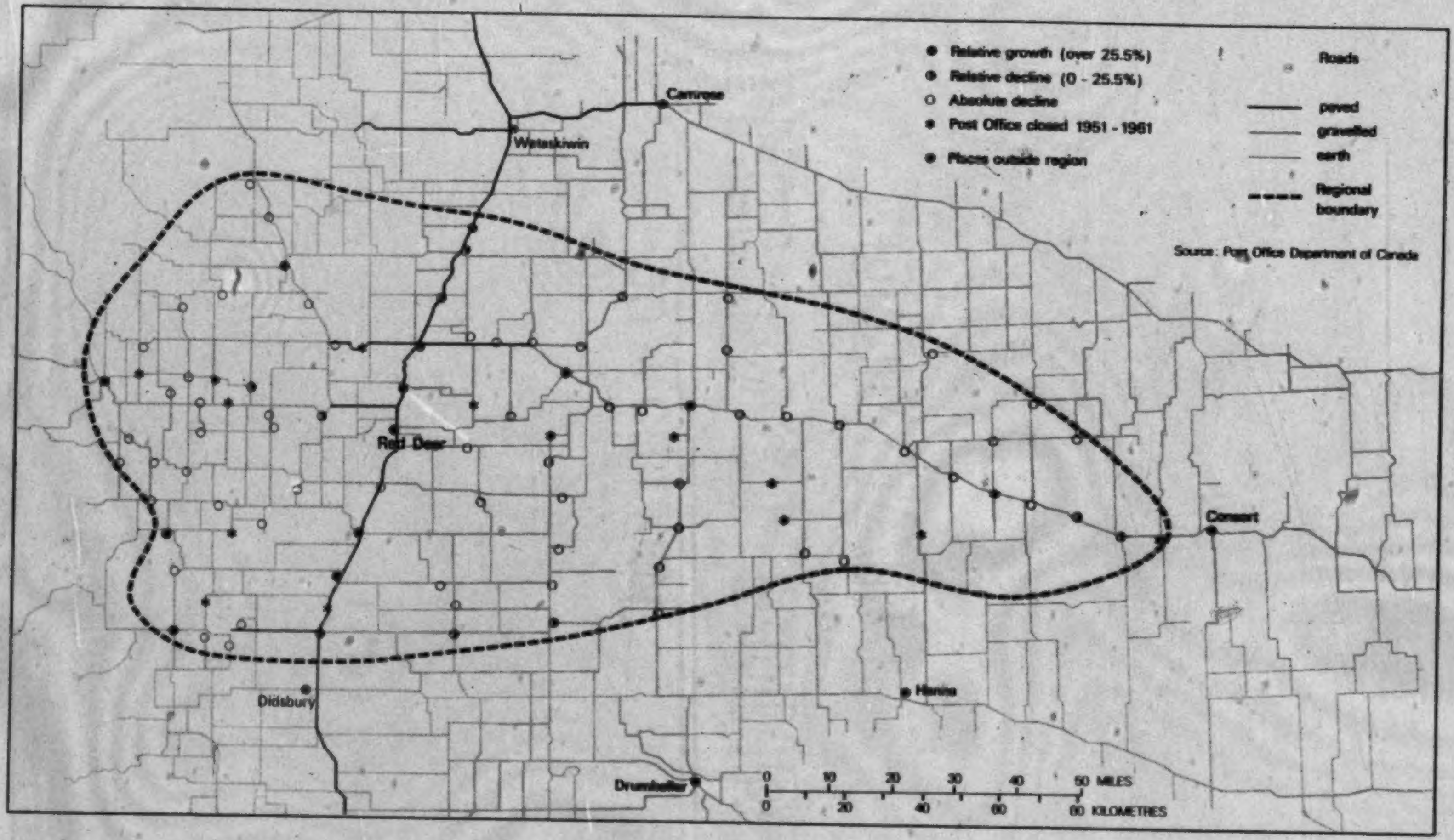


Figure 12   PLACES WITH POST OFFICES EVER PRESENT, 1941 - 1971



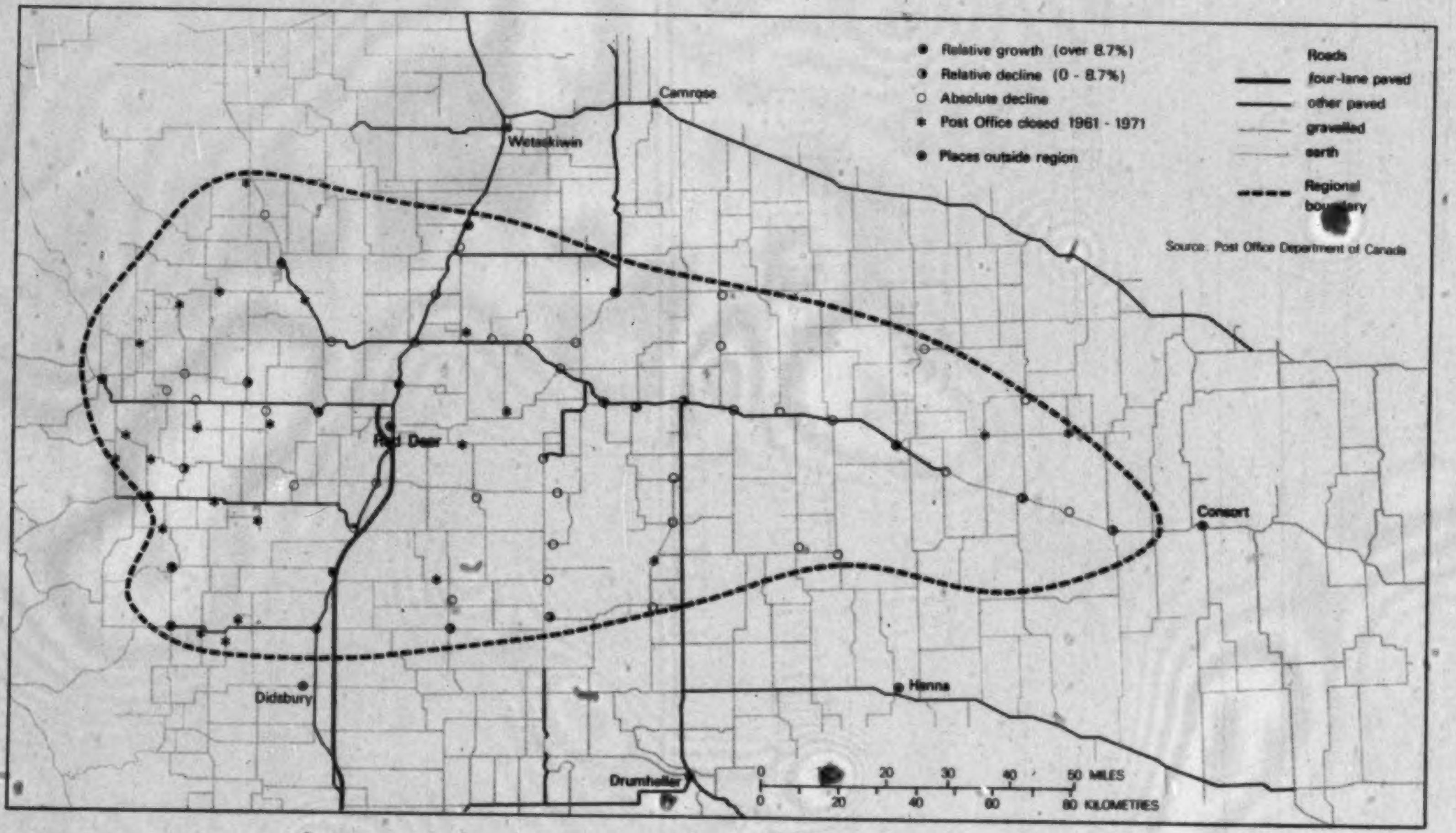
Source: Post Office Department of Canada

Figure 13 PERCENTAGE CHANGE IN POST OFFICE REVENUE, 1941-1951



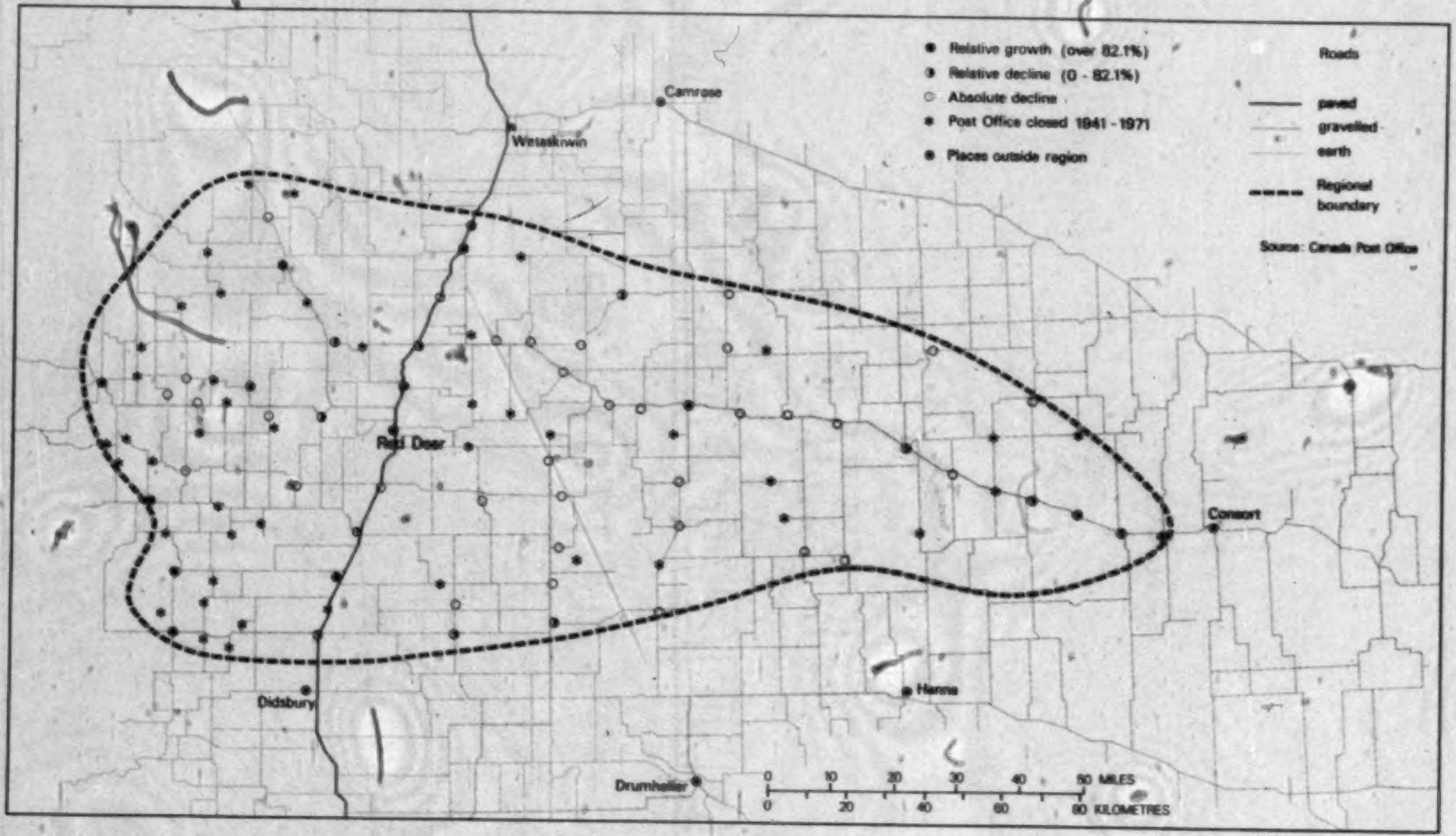
Source: Post Office Department of Canada

Figure 14 PERCENTAGE CHANGE IN POST OFFICE REVENUE, 1951-1961



Source: Post Office Department of Canada

Figure 15 PERCENTAGE CHANGE IN POST OFFICE REVENUE, 1961-1971



Source: Canada Post Office

Figure 16 PERCENTAGE CHANGE IN POST OFFICE REVENUE, 1941-1971

wrongly classifying individual places. Inspection of the figures indicates that the frequency of growing places is higher for the period 1941-51 than for succeeding decades, and suggests general tendencies for growing places to be concentrated along the Edmonton-Calgary corridor and near the western border of the region. East of Red Deer, declining centres outnumber centres showing increases in revenue; this is particularly the case after 1951.

REPLICATIVE ANALYSES

In replicating the research of previous students, an initial advantage framework was chosen, the assumption being made that various characteristics of places at particular points in time determine their growth performances over succeeding periods. Regression and chi-square analyses were carried out to test for the existence of expected associations between percentage change in post office revenue (the dependent variable) and a series of predictor variables (initial size, time-distance from selected competing centres and quality of road connections) suggested to bear some relationship to growth and decline among central places (see above, pp. 20-31, 65-66). Since parametric techniques such as regression require that the values of the input variables be normally distributed, each variable was inspected for this quality and appropriate transformations were made where necessary. Complete normality of distribution is almost impossible to achieve, however, and in most cases the degree of skewness, even in the untransformed data, was felt to be insufficient to unduly bias the results. The statistical results for each analysis are reported in the tables which accompany the discussion, and a selection of the relevant regression diagrams is included.

Initial Size

The two independent variables chosen to describe size of place at the beginning of each of the periods under examination were post office revenue (Appendix F, Table 2) and functional score (Appendix B). Since the distribution of sizes in a central place hierarchy is invariably positively skewed, both were logarithmically transformed in order to normalize the distribution. The two variables themselves are closely associated (r values, significant at the .001 level, vary between +0.93 and +0.96 for census years between 1941 and 1971), and accordingly they perform similarly as predictors of change in the dependent variable. The correlation coefficients tend to be marginally higher when functional score is taken as the independent variable (Table 26); the values of functional scores for individual places tend to vary less over time than do revenues and the scores may be considered the more stable indicators of size.

In all cases the expectation of a positive relationship between size at the beginning of a particular period and growth performance thereafter is borne out. The coefficients are low, however, though with the exception of the decade after 1961 they are statistically significant at normally-accepted levels for the sizes of universe specified. Only for the period 1951-61 is more than 20 per cent of the variation in rate of change in revenue explained by size of place at the beginning of the period, and the degree of variability in both the correlation and the regression coefficients suggests that size of place is not a stable predictor of future performance. Nevertheless the results are encouraging. Given the large number of very small places involved and the high degree of randomness usually assumed to

TABLE 26

RELATIONSHIPS BETWEEN INITIAL SIZE OF PLACE AND PERCENTAGE CHANGE IN POST OFFICE REVENUE

Independent Variable	Dependent Variable	Size of Universe	Correlation Coefficient (r)	Coefficient of Determination (r^2)	Regression Coefficient	Standard Error of Estimate	Regression Equation
Log. Functional Score	% Revenue Change						
1941	1941-51	96	0.318**	0.101	20.329	46.241	Y = -12.545 + 20.329X
1951	1951-61	81	0.508***	0.258	22.946	30.390	Y = -44.920 + 22.946X
1961	1961-71	58	0.153	0.023	6.757	32.520	Y = -15.268 + 6.757X
1941	1941-71	58	0.363**	0.132	53.886	94.670	Y = -64.052 + 53.886X
Log. Post Office Revenue							
1941	1941-51	96	0.256*	0.066	20.646	47.141	Y = -55.943 + 20.646X
1951	1951-61	81	0.467***	0.218	25.061	31.191	Y = -99.800 + 25.061X
1961	1961-71	58	0.175	0.031	8.505	32.398	Y = -34.930 + 8.505X
1941	1941-71	58	0.363**	0.132	69.600	94.671	Y = -226.147 + 69.600X

*Significant at the .05 level

**Significant at the .01 level

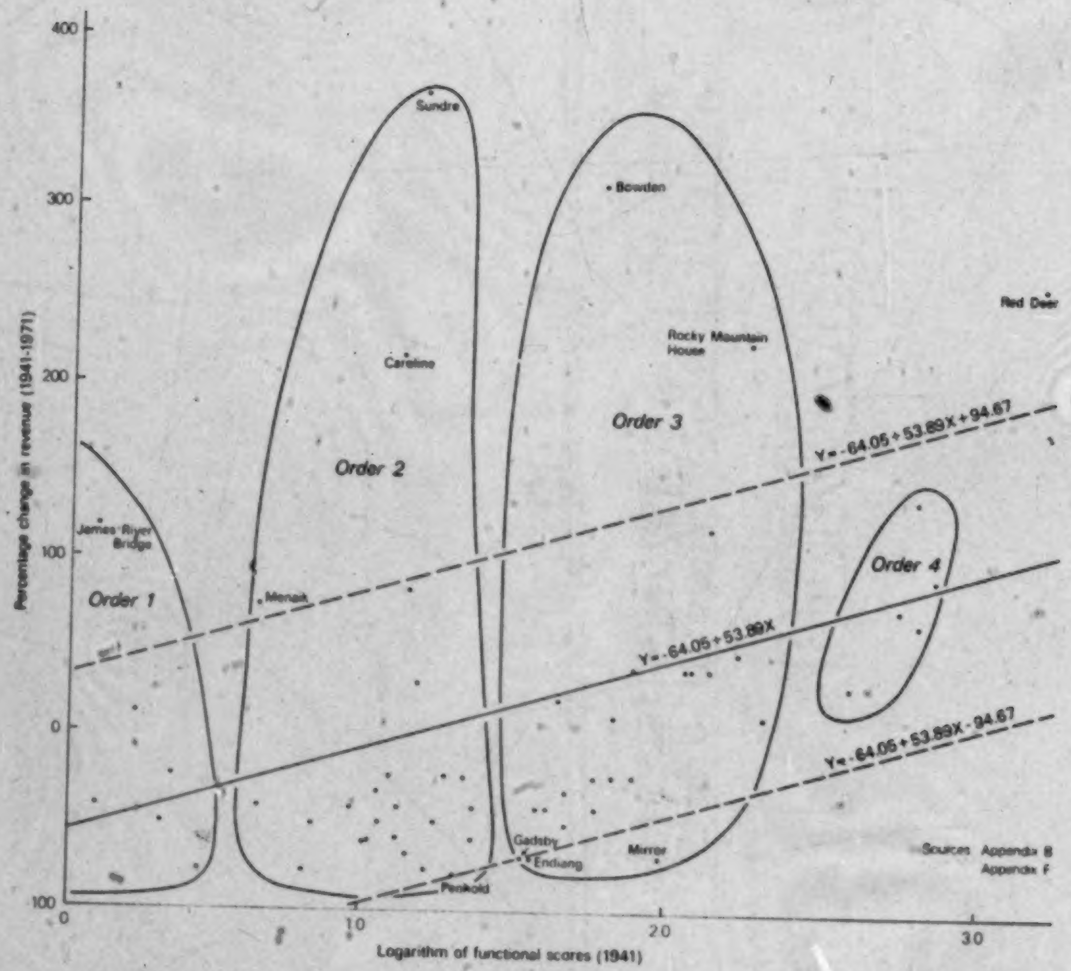
***Significant at the .001 level

Sources: Appendix B, Appendix F

characterize the growth behaviour of such places, it is perhaps surprising that the correlations compare favourably with those obtained by researchers who have employed demographic data to index size and growth and who have generally excluded the smaller centres from consideration (see, for example, Hodgson, 1972; King, 1964; Tarver and Beale, 1968). There is some evidence, in fact, that trends in population, post office revenue and numbers of operating establishments vary substantially even among the same set of places. Simple inspection of Table 14 and Appendix F (Table 2) reveals that in almost all cases in which population decreased, the decline was anticipated by reductions in revenue. A similar, if less pronounced, tendency is evident when Table 14 and Appendix E are compared in an examination of trends in population size and numbers of operating establishments. It is apparent that choice of data to express change will influence the conclusions that may be drawn about degree and direction of change. Stabler's (1973, p. 16) analysis of reorganization in the central place system of south-eastern Saskatchewan indicated that in a six-order hierarchy, five orders showed an increase in mean population of centres between 1961 and 1970 but only one showed an increase in mean number of retail outlets. In a central place system, it would appear, an analysis based exclusively on demographic data may result in misleading conclusions being drawn regarding the growth performances of trade centres.

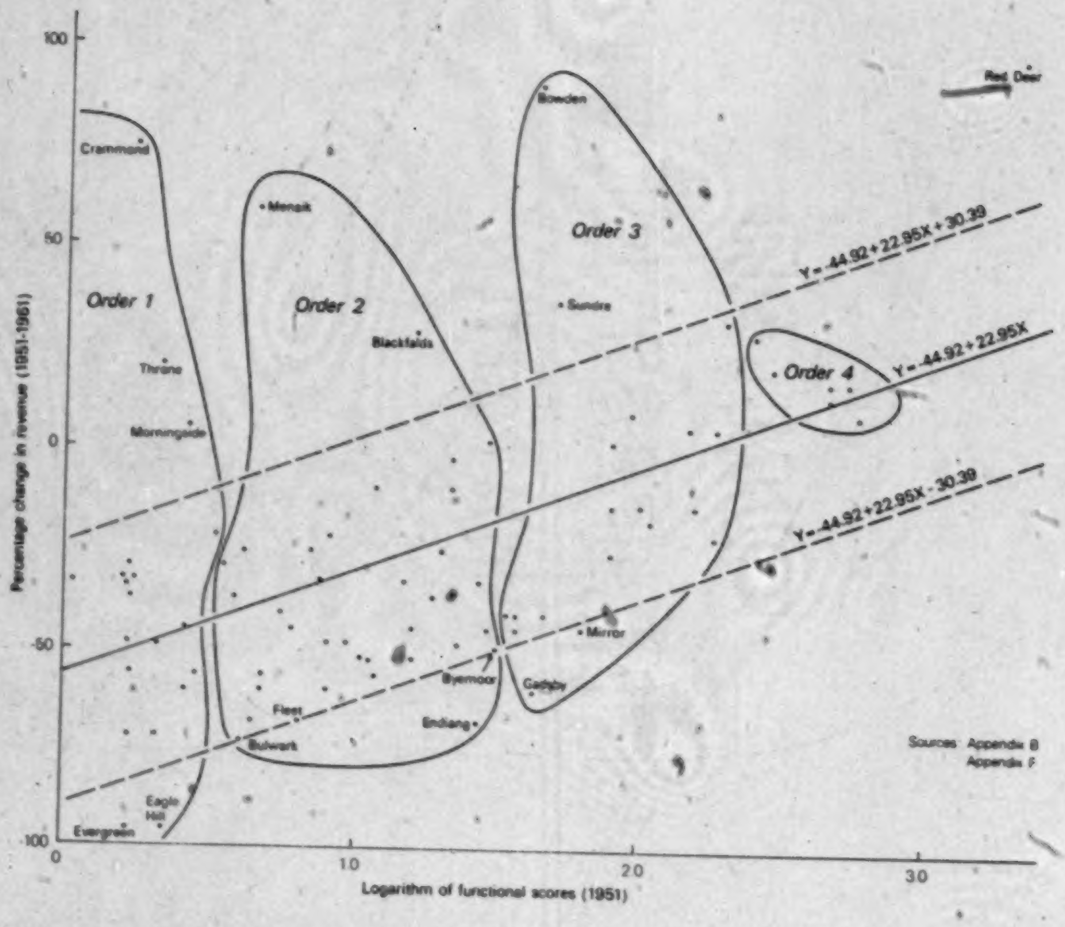
Despite the fact that functional score and revenue both appear capable of explaining some of the variation in the growth behaviour of central places, the coefficients are small enough to suggest that an examination of the residuals from regression should be attempted. For each decade and particularly for the period 1941-71, these residuals suggest that location may be an important factor in the differentiation of rates of change in revenue (Figures 17 and 18).

The strongest generalization which can be drawn from Figure 17 is that centres situated near the western margin of the region tend to be underpredicted when the logarithm of functional score forms the independent variable. Four such centres (Rocky Mountain House, Sundre, Caroline and James River Bridge) have Y values located more than one standard error of estimate away from the regression line; other places were similarly underpredicted for individual decades (see Figure 18). The western edge of the region has experienced a slight expansion in agricultural area since 1945, together with an expansion in extractive industries (see above, p. 54 and Jensen, 1972, p. 4). In any case most of the unincorporated rural townships between Sundre and a point just north of Rocky Mountain House have shown increases in population since 1941 (Figure 19), and this growth can be interpreted as adding support to the trading functions of central places in the area. Such growth was not characteristic of the region as a whole; indeed the only other sizeable tract outside the incorporated centres to experience growth was a cluster of rural townships centred on Red Deer. Elsewhere decline is characteristic and tends to become more pronounced toward the east. In the latter area the loss of support population likely has a bearing on the fact that the growth rates of central places east of Red Deer are overpredicted by the regression line in almost all cases; this overprediction is particularly marked for the smaller third-order places (most of which had fallen to the second order by 1971) and the centres of the second order. Surprisingly, the centres located in the corridor are not consistently underpredicted, as might



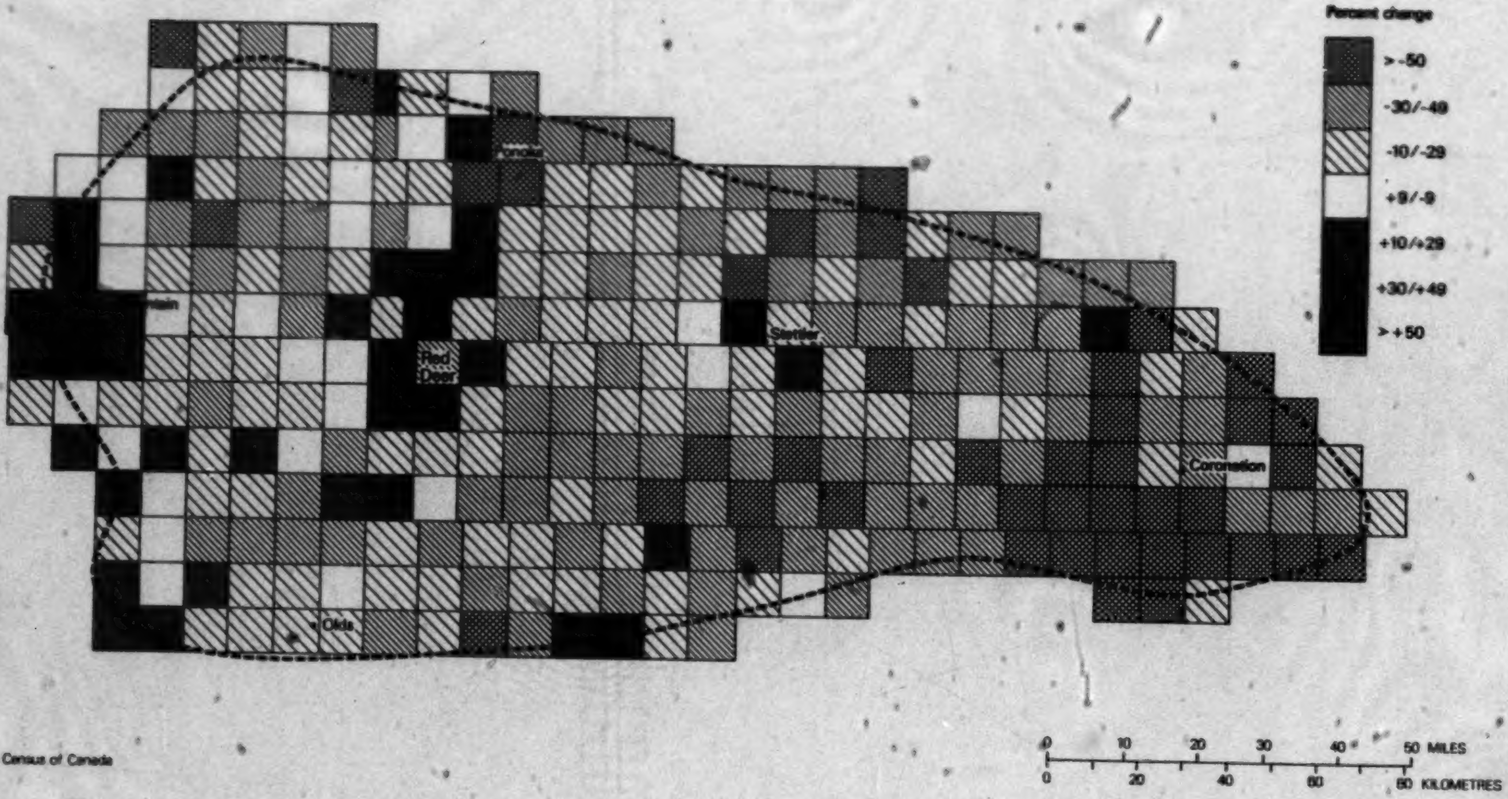
Sources: Appendix B
Appendix F

Figure 17 REGRESSION OF RATE OF CHANGE IN POST OFFICE REVENUE (1941-1971) ON LOGARITHM OF FUNCTIONAL SCORE (1941)



Sources: Appendix B
Appendix F

Figure 18 REGRESSION OF RATE OF CHANGE IN POST OFFICE REVENUE (1951-1961) ON LOGARITHM OF FUNCTIONAL SCORE (1951)



Source: Census of Canada

Figure 19. PERCENTAGE CHANGE IN POPULATION OF UNORGANIZED RURAL TOWNSHIPS, 1941-1971

have been expected given the orientation of the major highways. Only Red Deer, Bowden and Menaik have growth rates for the period 1941-71 which are in excess of one standard error away from the regression line. Rates of change for the fourth-order corridor centres are, in general, adequately predicted.

For the individual decades, similar though less striking patterns of residuals occur. Again the centres along the western border tend to be underpredicted while the majority of the places east of Red Deer are overpredicted (Figure 18). Considerable variability is apparent in the case of some of the smaller centres, however. Some which do not show consistent growth over the entire period are nevertheless underpredicted for particular decades (Crammond and Morningside are examples for 1951-61). No clear pattern is evident for centres located in the corridor.

Time-Distance from Selected Competing Centres

Of the multitude of potential measures which could have been employed to express the relative locations of central places, three were selected to act as independent variables in the prediction of growth and decline in post office revenue: time-distance to the nearer of Edmonton and Calgary, time-distance to Red Deer and aggregate time-distance to the ten nearest neighbours. The first two measure distance to major high-order competitors and the third measures the local density of rival centres irrespective of order. In all three cases the distance measured was that which pertained at the beginning of the particular period under examination.

The expectation was that in all cases a positive relationship between time-distance (expressive of degee of isolation from competing centres) and growth in revenue would be apparent (see above pp. 22-26, 65-66). Such was not the case, however: all correlation and regression coefficients were negative. None of the r values was above 0.40, but except for those pertaining to distance from Red Deer most were significant beyond the .05 level and in comparison with those derived from the size variable the coefficients tended to remain stable over time. Coefficients for individual decades were, in general, slightly lower than those for the thirty-year period (Table 27).

These results indicate that distance from competitors does not provide insulation against incursion into trade areas and therefore continued increases to existing volumes of trade. Indeed, the negative slopes of the regression lines imply that spread effects from major centres are more important than competitive effects in determining rates of change in revenue among smaller centres. It is difficult to gauge, however, what types of spread effects might be operative. Perhaps the simplest are those associated with the outward expansion of commuting fields. Commuting to Edmonton and Calgary no doubt now takes place over longer distances than was the case thirty years ago, but even as late as 1971 no centres within the region were situated within an hour's travelling time of either city and the amount of commuting from the region is probably minimal. Similarly Red Deer's labour shed includes only a small number of surrounding centres: population growth in these places, even assuming concordant growth in post office revenues, would be insufficient to explain the negative coefficients obtained. An alternative perspective on the possible existence of spread effects from major centres can be obtained from

TABLE 27

RELATIONSHIPS BETWEEN TIME-DISTANCE FROM SELECTED RIVAL CENTRES AND PERCENTAGE CHANGE IN POST OFFICE REVENUE

Independent Variable	Dependent Variable	Size of Universe	Correlation Coefficient (r)	Coefficient of Determination (r^2)	Regression Coefficient	Standard Error of Estimate	Regression Equation
Time-distance from nearer of Edmonton and Calgary	% Change in revenue						
1941	1941-51	96	-0.251*	0.063	-1.427	47.207	Y = 44.028 - 1.427X
1951	1951-61	81	-0.268*	0.072	-1.338	33.978	Y = 99.641 - 1.338X
1961	1961-71	58	-0.272*	0.074	-1.691	31.664	Y = 22.023 - 1.691X
1941	1941-71	58	-0.305*	0.093	-3.653	96.778	Y = 103.611 - 3.653X
Time-distance from Red Deer							
1941	1941-51	96	-0.162	0.026	-0.923	48.127	Y = 21.550 - 0.923X
1951	1951-61	81	-0.236*	0.055	-1.176	34.278	Y = -4.629 - 1.176X
1961	1961-71	58	-0.173	0.030	-1.049	32.412	Y = 3.413 - 1.049X
1941	1941-71	58	-0.237	0.056	-2.754	98.706	Y = 52.409 - 2.754X
Aggregate time-distance from ten nearest neighbours							
1941	1941-51	96	-0.242*	0.058	-1.432	47.322	Y = 59.566 - 1.132X
1951	1951-61	81	-0.320*	0.102	-1.284	33.420	Y = 31.716 - 1.284X
1961	1961-71	58	-0.217	0.047	-0.837	32.121	Y = 22.502 - 0.837X
1941	1941-71	58	-0.397**	0.158	-3.931	93.247	Y = 190.280 - 3.931X

*Significant at the .05 level

** Significant at the .01 level

Sources: Appendix F, Appendix G.

an inspection of the lists of functional units and establishments present in central places (Appendices A and B). If centres close to Red Deer, Edmonton and Calgary (primarily the centres located in the corridor) were adding functions more quickly or losing them less quickly than more distant centres of similar order, it could be argued that spread effects were operative. No evidence of such differences is apparent from the lists, however.

A more plausible explanation of the negative relationships observed in the case of distance to major centres would appear, at first sight, to be that the distance variables overlap the size variable discussed in the previous section. Size and propensity for growth are positively related, and the distribution of centres by order has already been noted as exhibiting a concentration of the larger centres within the corridor (see above, p. 98 and Figures 7-10). Corridor centres are located close to Red Deer and to one or the other of Edmonton and Calgary. Since large places are known to be associated with growth, the fact of their distributional pattern could be said to "explain" the distance relationships if a negative association between size and distance could be demonstrated. The association is indeed negative (Table 28), but its strength is low and except for 1961 the correlation coefficients are not significant. The distribution of central places by size is apparently of no more than minor importance in explaining the negative slopes of the regression lines in Figures 20 and 21. An alternative explanation, however, is provided by inspection of Figure 19. Except for the western margins of the region, the pattern of change in rural population is one of increasing propensity toward decline with distance from Red Deer. Since time-distance from Red Deer

TABLE 28

MATRICES OF INTERCORRELATIONS BETWEEN INITIAL SIZE AND TIME-DISTANCE VARIABLES: 1941, 1951, 1961

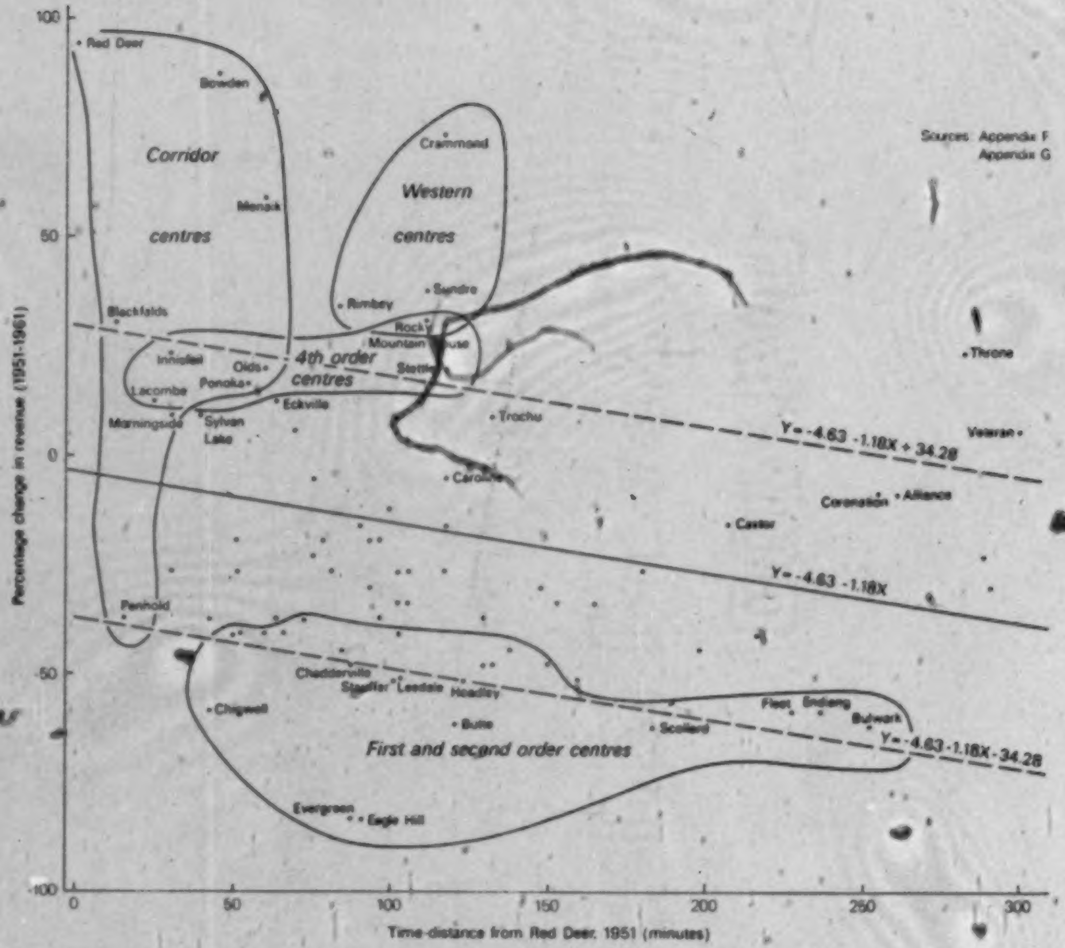
Year	Size of Universe	Variable	Log. of Functional Score (1)	Log. of Post Office Revenue (2)	Time-Distance to Nearer of Edmonton, Calgary (3)	Time-Distance to Red Deer (4)	Aggregate Time-Distance to Ten Nearest Neighbours (5)
1941	96	(1)	1.000	0.925***	-0.161	-0.148	-0.102
		(2)		1.000	-0.184	-0.188	-0.144
		(3)			1.000	0.908***	0.578***
		(4)				1.000	0.669***
		(5)					1.000
1951	81	(1)	1.000	0.951***	-0.137	-0.159	-0.132
		(2)		1.000	-0.177	-0.195	-0.147
		(3)			1.000	0.887***	0.588***
		(4)				1.000	0.663***
		(5)					1.000
1961	58	(1)	1.000	0.963***	-0.242	-0.249	-0.194
		(2)		1.000	-0.267*	-0.284*	-0.245
		(3)			1.000	0.864***	0.622***
		(4)				1.000	0.786***
		(5)					1.000

*Significant at the .05 level

**Significant at the .01 level

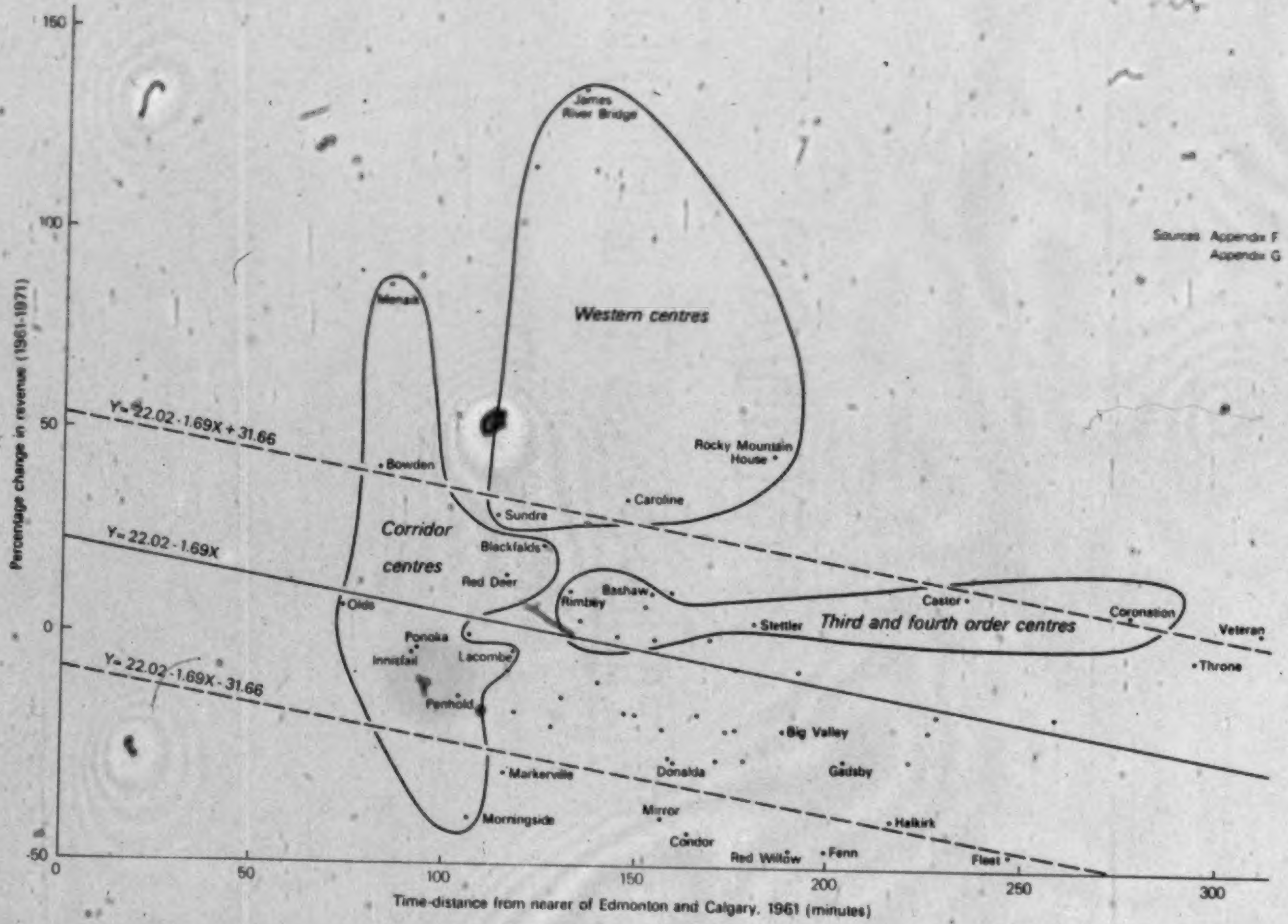
***Significant at the .001 level

Sources: Appendix B, Appendix F, Appendix G.



Sources: Appendix F
Appendix G

Figure 20 . REGRESSION OF RATE OF CHANGE IN POST OFFICE REVENUE (1951-1961) ON TIME-DISTANCE FROM RED DEER (1951)



Sources: Appendix F
Appendix G

Figure 21 REGRESSION OF RATE OF CHANGE IN POST OFFICE REVENUE (1961-1971) ON TIME-DISTANCE FROM THE NEARER OF EDMONTON AND CALGARY (1961)

and time-distance from the nearer of Edmonton and Calgary are highly correlated (Table 28), it can be seen that the pattern of change in rural population will bear upon both relationships. Indeed, it may be that the distance-growth associations observed are more properly stated as relationships between revenue change and trends in the sizes of local support populations.

Inspection of the residuals from the regressions supports the contention that location (and in some cases size) impinge upon the relationships. In the case of time-distance from Red Deer, the growth rates of centres in the corridor tended to be underpredicted for the decade after 1951, as was the case for fourth order centres in general and for places located near the western margins of the region (Figure 20). Heavy overprediction appeared to characterize first- and second-order centres regardless of location. It should be noted, however, that for other periods (when the strength of the relationship between distance and change in revenue was such that desired significance levels were not achieved), these patterns of residuals were much less pronounced. Positive residuals from the regression involving time-distance from the nearer of Edmonton and Calgary again include the western centres, places in the corridor being inconsistently predicted. Up to 1961 the latter grew more rapidly than was predicted by distance alone, but thereafter the fourth-order corridor centres were overpredicted (Figure 21). Again, however, most of the places which grew less or declined more than predicted by the regression equations were small.

For the regression of rate of change in post office revenue upon aggregate distance to the ten nearest neighbours, the relationship was again inverse for all time periods. Revenues of places located in close proximity to neighbours are therefore more likely to increase (and less likely to decrease) than are those of relatively isolated centres. This finding too is difficult to explain, but the pronounced decline in rural populations in the eastern half of the region, where centres are widely spaced (Figures 7-10), presumably contributes to the inverse form of the relationship. It is also noteworthy that centres in the far eastern portion of the region tend to have been connected later to the system of hard-topped roads than were centres nearer the corridor (see Figures 7-10). In the following section it is shown that increasing quality of highway connections tends to be associated with a lessened incidence of decline in revenue. Inspection of the residuals from regression was not, in this case, particularly helpful in providing understanding of those instances where prediction was poor (Figures 22 and 23). When the period 1941-71 is considered, however, there is evidence that the performances of the fourth-, fifth- and larger third-order centres tend to be underpredicted, though in general the degree of error is slight. Most of the smaller centres, irrespective of distance to neighbours, are overpredicted.

Quality of Road Connections

To test for the existence of the expected associations between change in revenue and quality of road connections, a means of classifying centres by road type was required. The highest class of road on which a centre was situated was selected (Hobbs and Campbell, 1967; see also Table 23). The data were then arrayed in three-by-three contingency tables, the rows representing quality of road surface (ordinally ranked) and the columns representing direction and degree of change in

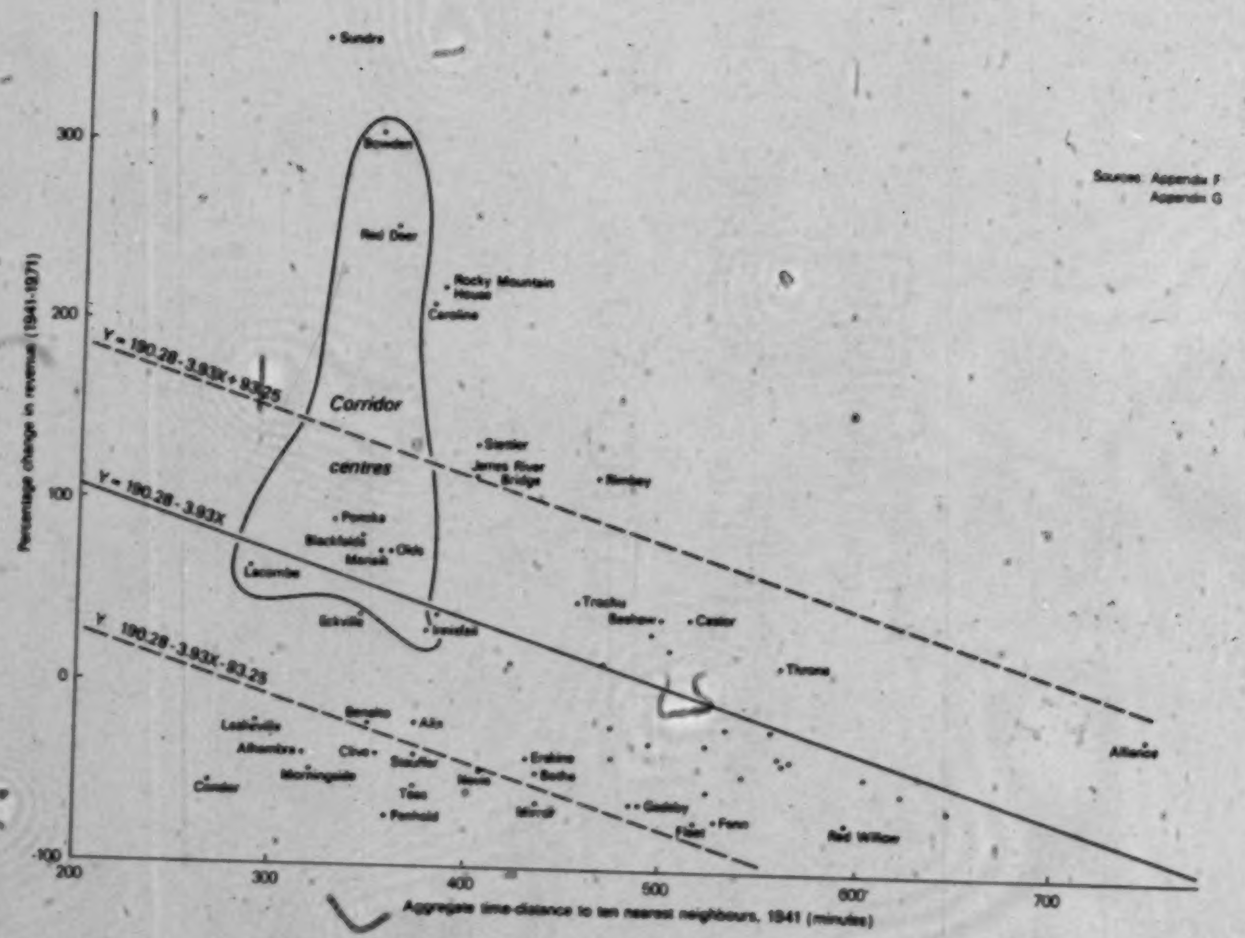
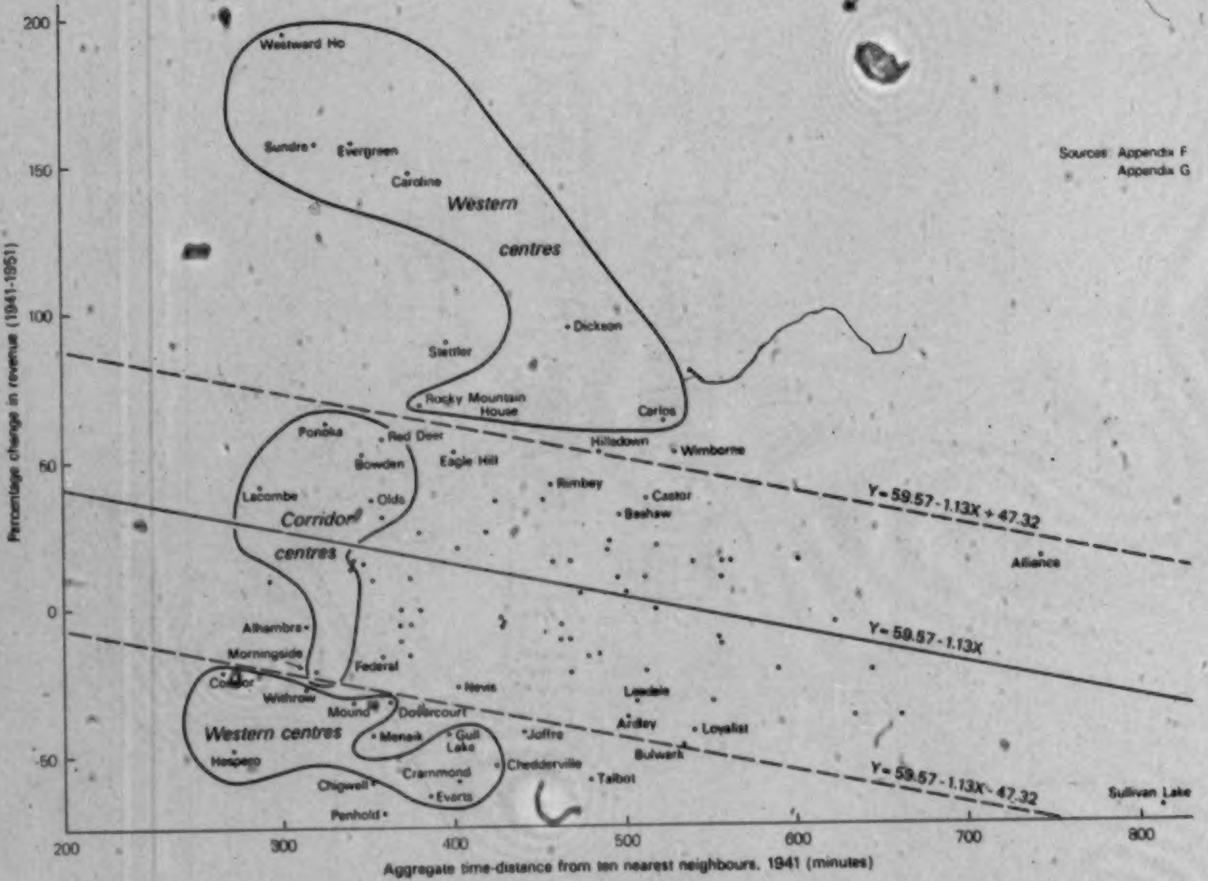


Figure 22 REGRESSION OF RATE OF CHANGE IN POST OFFICE REVENUE (1941-1971) ON AGGREGATE TIME-DISTANCE TO THE TEN NEAREST NEIGHBOURS (1941)



Sources: Appendix F
Appendix G

Figure 23 REGRESSION OF RATE OF CHANGE IN POST OFFICE REVENUE (1941-1951) ON AGGREGATE TIME-DISTANCE FROM TEN NEAREST NEIGHBOURS (1941)

revenue (see Figures 13-16). In all cases these tables suggested an increasing propensity for growth (and conversely, a decreasing propensity for decline) with increasing quality of road surface (Table 29).

Chi-square tests were carried out to determine whether the differences between observed and expected frequencies were statistically significant. Yates' correction factor was applied throughout, since in all tables at least one cell had an expected frequency of less than five cases (see Blalock, 1972, pp. 285-87). The effect of this modification was to reduce the chi-square value and thus the significance levels applicable to the differences between observed and expected values.

In the case of the three-by-three tables, the hypothesis of independence was rejected in only one period (1951-61) out of three.[1] The relevant statistics for 1951-61 were: $\chi^2 = 14.30$, d.f.4, $P < .01$. To allow the inclusion of the decade after 1961, the data were reformulated with the earth and gravelled road categories combined to give three-by-two tables. The analysis was repeated and significant differences were revealed for the period after 1961 ($\chi^2 = 7.66$, d.f.2, $P < .05$). For 1941-51 and 1941-71 the chi-square values derived were significant only at the 0.1 levels and the null hypothesis could not safely be rejected. When the data were once more reformulated, this time by combining the categories of relative growth and relative decline, the chi-square statistic was significant for the thirty-year period ($\chi^2 = 7.45$, d.f.1, $P < .05$) but not for the decade after 1941. It must be concluded that while the chi-square values are in general not high, significant differences between observed and expected values

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[1] The decade after 1961 was excluded from consideration, since the post offices of all three places located on earth roads in 1961 were closed by 1971.

TABLE 29

ASSOCIATIONS BETWEEN CHANGE IN POST OFFICE REVENUE AND QUALITY OF ROAD ON WHICH PLACES OCCUR

Period	Class of Road (Initial date)	Relative Growth	Relative Decline	Absolute Decline	Totals
1941-51					
	Earth	9	18	33	60
	Gravelled	7	6	12	25
	Paved	6	2	3	11
	Totals	22	26	48	96
1951-61					
	Earth	0	0	14	14
	Gravelled	4	8	42	54
	Paved	5	4	4	13
	Totals	9	12	60	81
1961-71					
	Earth	0	0	0	0
	Gravelled	1	6	21	28
	Paved	11	5	14	30
	Totals	12	11	35	58
1941-71					
	Earth	2	5	20	27
	Gravelled	4	5	12	21
	Paved	4	4	2	10
	Totals	10	14	34	58

Source: Official Road Maps, Province of Alberta; 1941, 1951, 1961.

are apparent. Visual inspection of the tables indicates that direction of change in post office revenue covaries with quality of road surface in the manner anticipated.

Evaluation of Replicative Analyses

A series of analyses was performed in which variables found by previous researchers to be associated with growth and decline among central places were re-examined in the context of the Red Deer region. In general, the expected relationships were borne out, except that in the case of the distance variables the sign of the coefficient was the opposite of that anticipated. This finding could not be explained except by reference to other variables, not all of which were included in the formal analysis. Time-distance from major centres and near neighbours, it was concluded, may not play a major role in the differentiation of the growth performances of central places. The observed relationships between distance and change in post office revenue are probably more apparent than real. Much more important in predicting change in revenue are initial size of place, location, and trends in local rural populations. Of these, however, size at least is no stable predictor.

The fact that statistically significant associations were discerned in these analyses is encouraging. Most of the central places in the study area are very small: indeed in 1961 the median population size of the centres operating post offices was less than one hundred and the median number of central establishments was only eight. Previous studies of the growth performances of central places have excluded such small centres from consideration, partly on the grounds that trends in their population sizes are so erratic as to defy explanation. When change in post office revenue is taken as the dependent variable, however, partial explanations of differentials in the degrees and directions of change are possible for minor trade centres.

TESTING OF HYPOTHESES

The replicative analyses proceeded from the basic assumption inherent in the concept of initial advantage: that is, that the growth performances of centres over a period are assumed to be a function of conditions pertaining at the beginning of the period. An approach which considers the operation of processes, however, must be capable of including temporal variation in those independent variables which represent the energizing agents altering the structures of particular systems. Processes are difficult to model, however, particularly in the social sciences where understanding of causal mechanisms is often relatively weak. A common approach is to hypothesize (often by deduction from existing theory) the operation of a particular process and to test for the existence of the assumed process by modelling it in an empirical situation (see Harvey, 1969, p. 429). Difficulties arise, however, since such modelling involves measurement problems and consequently further (often arbitrary) assumptions are necessitated. None the less approaches from the standpoint of initial advantage leave much of the variation in the dependent variable unexplained, and a process approach is required to bridge the gap in explanation. In the following paragraphs an attempt is made to model those processes which logically should result in changes in locational utilities and shifts in trade area boundaries and therefore in shifts in the spatial orientations of consumer demand.

Hypotheses One and Two

The first two hypotheses predicted the effects of time-space convergence on the growth performances of central places. For each place in any period of time, the ten nearest neighbours were considered as rivals (in all cases the relevant places are among those shown in

Figure 12). Travel-time distance was measured to each in the initial year of each period and the resulting values were summed. For the same neighbours, travel-time distance was measured again for the end of the period and these values were also summed. The difference between the two totals represents a measure of the total convergence of a place on its rivals. This value was divided by the sum of the shortest-path mileage distances[2] to the ten neighbours and gave a convergence measure stated as a rate (minutes saved per mile).

The universe of places within the region was subdivided into growing places and declining places (see above, pp. 67-68), and for each group rate of change in post office revenue was regressed upon rate of time-space convergence. The number of places involved was in some cases small--the smallest universe was of growing places for the period 1951-61, when only twenty-one centres were included. In this instance a correlation coefficient of approximately 0.40 was required to achieve statistical significance at the .05 level. For the remaining analyses the number of cases was larger, the smallest universe of declining centres being 34 for the decade after 1961.

As it happens, the small sizes of universe do not appear to have greatly affected the results. The hypotheses are emphatically not supported: the correlation coefficients were in all cases small, not statistically significant and--most importantly--of inconsistent sign (see Table 30). Little if anything can be said of these results, and in fact there seems to be no point in including the complete range of

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[2] Measuring the distance-separation of places in miles over the shortest path rather than over the quickest route between places was an economizing measure necessitated by computing costs. The distortion introduced is probably minor: in nearly three-quarters of the cases, the shortest-mileage and shortest-time routes were the same.

TABLE 30

ASSOCIATIONS BETWEEN RATE OF TIME-SPACE CONVERGENCE AND PERCENTAGE CHANGE IN POST OFFICE REVENUE, SEPARATELY FOR GROWING AND DECLINING PLACES

Universe of Places	Dependent Variable	Period	Size of Universe	Correlation Coefficient
Growing centres	% growth	1941-51	48	0.093
Growing centres	% growth	1951-61	21	-0.258
Growing centres	% growth	1961-71	22	-0.353
Growing centres	% growth	1941-71	24	-0.293
Declining centres	% decline	1941-51	48	-0.159
Declining centres	% decline	1951-61	60	0.091
Declining centres	% decline	1961-71	36	-0.043
Declining centres	% decline	1941-71	34	-0.051

Sources: Appendix F, Appendix H.

statistics from the regression analyses. Even when convergence was expressed as an absolute value (minutes saved) rather than as a rate (minutes saved per mile), no consistent pattern emerged among the coefficients. At this scale of system, it appears that a link between the phenomenon of time-space convergence and the growth performances of central places cannot be demonstrated. There is, of course, the lingering problem of the method by which the convergence variable was operationalized. Opting for defining the ten nearest neighbours as rival centres for each place begs a number of questions regarding competitive relations between central places. Alternative definitions--based for example on the construction of Thiessen polygons to approximate trade areas and thereby to enumerate competing centres--would, however, have involved the incorporation of a number of arbitrary assumptions that would have left the measurements unfaithful to the hypothesized process being modelled. Despite its deficiencies, the method adopted should, had the process operated as Figure 1 suggested, have been capable of providing a test. It is concluded that locational utilities and trade area boundaries are not altered by the shrinkage of space in the manner predicted.

Hypotheses Three and Four

The aim of the third and fourth hypotheses was to predict the effect of growing central places on their near neighbours (see above, pp. 68-70). Briefly, it was anticipated that centres located in close proximity to growing places would be the first to experience decline as a result of loss of patronage, while centres situated farther away would only later show reductions in revenue. Again, the hypotheses were predicated on the notion of changes in locational utility and shifts in the boundaries of trade areas. Once more, however, the hypotheses were not supported by the evidence. For none of the three decade-long periods were the nearest neighbours of growing central places showing pronounced tendencies toward decline; similarly no evidence was derived to suggest that more distant places tended for any period to be protected from incursions into their trade areas and to maintain their growth rates as a result. There is, then, no evidence of competitive impulses being radiated spatially from growing centres. Most of the correlation coefficients were small, with no consistent patterns evident as to sign; only four of the forty coefficients calculated were statistically significant at an acceptable level (see Table 31). Inspection of Figures 13-16 shows why this is the case. Growing centres are not evenly spaced throughout the region. Within

TABLE 31

NEAR-NEIGHBOUR CORRELATION FUNCTION: ASSOCIATIONS BETWEEN THE RATES OF CHANGE OF GROWING PLACES AND THOSE OF THEIR NEAR NEIGHBOURS

Period	Number of Growing Places	Order of Neighbour	Correlation Coefficient
1941-51	48	1	0.160
		2	0.080
		3	-0.066
		4	0.037
		5	-0.114
		6	0.244
		7	-0.031
		8	0.152
		9	0.057
		10	0.291*
1951-61	21	1	0.157
		2	-0.152
		3	-0.005
		4	0.170
		5	-0.289
		6	0.224
		7	0.152
		8	-0.139
		9	-0.270
		10	0.136
1961-71	22	1	0.233
		2	0.462*
		3	-0.087
		4	0.445*
		5	0.279
		6	0.009
		7	-0.006
		8	0.107
		9	0.140
		10	-0.087
1941-71	24	1	0.115
		2	0.086
		3	-0.135
		4	0.280
		5	0.665*
		6	0.317
		7	0.333
		8	-0.128
		9	0.199
		10	-0.234

*Significant at the .05 level

Source: Appendix F

the corridor a majority of centres was growing in each period; elsewhere there were always a few small (first- and second-order) centres which, atypically for these two classes as a whole, were growing. Exclusion of all corridor centres from the lists of growing places failed to create significant changes to the coefficients.

These findings are illuminating, given the evidence previously submitted to the effect that competitive processes are active in the area. Total regional post office revenue has increased from decade to decade throughout the period, increasing by nearly 90 per cent between 1941 and 1971. Yet with the exception of the decade after 1941 when numbers of growing and declining places were evenly balanced, places losing revenue have consistently outnumbered those showing increases in revenue. The pattern, therefore, has been one in which a large number of small places have lost revenue, presumably to those usually large centres which have continued to grow, albeit at a decreasing rate (Appendix F, Table 2). No consistent spatial pattern appears: growing centres cannot be said to be attracting trade from nearby centres rather than from centres farther away.

Evaluation of Hypotheses

In all cases the hypotheses were rejected. No evidence could be found to support the proposition that the phenomenon of convergence bore any relation to trends in post office revenues, and growing centres appeared not to be capturing revenue from their near neighbours rather than from those situated farther away. No regular spatial pattern in the incidence of growth and decline in revenue was demonstrated. The modelling of hypothesized processes is at best a speculative procedure, since little is known about the manner in which processes operate and since practical problems associated with modelling itself tend to exacerbate the difficulties by reducing the rigour of the tests. It would be precipitate, however, to abandon entirely the notion of convergence in future analyses of the reorganization of central place systems. Meaningful generalizations about convergence at the aggregated level of the entire system were derived in the previous chapter (see above, pp. 127-33). Studies of particular areas at widely-spaced intervals have demonstrated that as the ease of movement increases, people move over greater distances to obtain goods and services. Trade areas expand and overlap, some centres penetrate the markets of others and shifts of patronage occur. The Walworth County (Wisconsin) studies have illustrated the continuing existence of these trends for a period of nearly forty years (for a general summary, see Kolb, 1959; the individual studies are Galpin, 1915; Kolb and Polson, 1933; and Kolb and Day, 1950). Even over much shorter periods some of the same trends are identifiable (Yoesting and Marshall, 1969). It is unlikely that similar occurrences have not applied in the Red Deer region over the last several decades, given the degree of increase in personal mobility that improvements in the transport network imply. The particular approach to modelling the impact of convergence which was adopted here, however, provides no evidence of these trends. One inference which may be drawn is that subtle variations in rates of convergence are not reflected in changes in travel behaviour or shifts in trade area boundaries. Consumers may react not to degree of convergence, but to the fact that strong convergence has taken place. If this is the case, it may be necessary to compare the growth performances of central places for regions showing marked differences in their experiences of the convergence phenomenon. Ideally, an area such as the Red Deer region, where considerable spatial shrinkage has occurred, should be compared with an area in which over the same period of time convergence has been virtually absent. Such an area would be difficult to find, however. Even this approach would involve the drawing of inferences about relations between travel behaviour and the quality of transport networks. Given the problems of compiling records of behaviour over time, it is difficult to see how empirical studies can greatly improve on existing knowledge about relationships between changes in travel behaviour and qualitative change in transportation systems.

Questions of scale also arise in deriving inferences from the results of these tests. Hitherto, the notion of convergence has been applied in the context of the growth performances of large cities rather than small central places (see, for example, Janelle, 1969). It should be reiterated here that the Red Deer region encompasses only the lower ranks of a wider central place hierarchy. The findings for centres of these ranks should not be taken as suggesting that time-space convergence is unrelated to the growth performances of places of higher order.

SUMMARY

Growth, it has been argued, is "inevitably the most difficult aspect of system behaviour to analyze" (Bourne and MacKinnon, 1972, p. 104; see also Berry, 1964, p. 10). Almost invariably, the approach to the explanation of differentials in the growth and decline (however measured) of central places has been cross-sectional and has adopted as a base the methodology associated with the concept of initial advantage. This concept has borne fruit in that a number of generalizations have been forwarded regarding the growth and decline of central places. Some of these generalizations were retested for the Red Deer area for the period 1941-71, though the measurement of change was carried out from data on post office revenue rather than from the demographic data traditionally employed. Consistent results were obtained: for all periods a direct relationship existed between initial size of place and propensity to grow, while growth was inversely related to time-distance from major cities and to the local density of neighbouring centres. Some doubt was cast on the ability of the distance variables to explain, independently of other variables which they subsume, variations in the growth propensities of central places. Places located on the higher quality surfaces of road were more likely to grow than were places not so located. Of the variables formally incorporated in the analyses, size of centre appeared to be predominant: its effect was noted in all relationships. The environment of the Red Deer central place system is far from homogeneous, however, and both location within the region and trends in local population appeared to bear upon the associations described. Overall the replicative analyses could be considered to have been only moderately fruitful, though in view of the large number of very small places involved the fact that statistically significant results were derived is encouraging. That most centres are declining while total regional post office revenue is increasing suggests that competitive processes are active, but an attempt to account for them was unsuccessful. Other approaches were suggested, but even these can be expected to meet with severe problems of operationalization.

CHAPTER V

CONCLUSIONS

The objective of this study has been to describe and explain the forms of reorganization undergone by a system of central places over a thirty-year period. Examination of the voluminous inter-disciplinary literature relating to differentials in the growth and decline of trade centres suggested the existence of deficiencies both in the measurement of change and in the conceptualization of the processes underlying it. Furthermore the emphasis has been on predicting degree and direction of change using data for individual centres as input; structural reorganization undergone by whole systems of central places has been given, at best, only secondary attention. In the present study an attempt was made, to the extent that time and data permitted, to overcome these deficiencies. Post office revenue (a surrogate for retail trade) was substituted for population in the measurement of growth and decline: these revenue data are regarded as providing a meaningful measure of the performances of trade centres in carrying out their roles within the space-economy. Data on the central functions operated from central places were collected for each of four dates and used to assign centres to ranks in the regional hierarchy; these same data permitted an examination of temporal change in the structure of the hierarchy and a discussion of trends in the provision of functions by centres of different orders. Some previously-employed hypotheses relating to the performances of central places themselves were retested, and an attempt was made to include reference to the action of hypothesized processes in creating differentials among the growth rates of trade centres.

THE FINDINGS: SYNTHESIS AND APPRAISAL

Two groups of findings may be identified, one concerned with reorganization at the aggregative level of the system as a whole and the other with the performances of the places themselves. For the Red Deer region, a loosely-defined hierarchy was identified for 1941, and this hierarchy tended to retain its form throughout the ensuing thirty years despite the fact that several centres changed rank during the period. Excluding the places which disappeared entirely, most changes of rank involved one-step shifts in a downward direction. A concomitant of this pattern of shifts was a pronounced centralization of service activities on the two highest orders of places. This concentration of functions appears to be operating at increasingly higher levels in the hierarchy; such a finding has implications for the long-term viability of even the larger trade centres in the region. Most of the centres of the three lowest orders appear to have uncertain futures and already more than half of the places which occupied the lowest rank in the hierarchy in 1941 have disappeared. The evidence suggests that the rate of mortality among small centres has increased since 1961, possibly as a belated reaction on the part of the system to the increasing density of such centres in time-space. Firm conclusions on the supposed tendency of systems of central places to control the growth rates of member places are difficult to draw, however. When the separation of near-neighbours was measured along the road network, no evidence was found to suggest that central places offering particular levels of service are becoming more regularly spaced. Nevertheless, it is noteworthy that those few centres which rose from lower levels to occupy the third and fourth ranks in the regional hierarchy were located in areas deficient in the provision of goods and services of these orders. Similarly, the decline in numbers of lower-order centres suggests that the density of such places is overly high given the changing environment of the system. Adjustment to changes in this environment is slow, however, and suggests the continued presence of inertia.

Two sets of analyses were also carried out in which the focus of attention was the growth and decline of individual places. The first of these was merely replicative of past research, though change in post office revenue was preferred as the dependent variable to change in population. A series of independent variables previously shown to bear upon changes in the size of places was incorporated. These analyses were moderately successful: growth appeared to be directly related to initial size of place and inversely related to distance from major centres and to the local density of centres. The positive relationship between size of place and propensity to grow has been a consistent finding for other regions and its validation in the Red Deer case is no surprise. Previous students have not agreed on the question of the nature of the growth--distance relationships obtaining among central places, but the consistently negative associations discerned for the Red Deer region were the opposite of those which--from a normative viewpoint--were expected. It is doubtful, however, whether distance was in fact the variable being expressed in these relationships. Location, change in local rural population and to some extent size of place all appeared to contribute to the negative associations observed. Places located on paved roads were shown to have a higher propensity for growth than did centres located on roads of lower quality; this was the case particularly after 1951. Again, however, size of place impinged upon the association.

While the degree of explanation achieved by the replicative tests was in all cases low, the fact that consistent and significant (if not always temporally stable) associations were discerned is encouraging. The correlation coefficients derived were in general as high as those obtained by other students. Most of the central places included in the study were very small. Past studies have traditionally excluded such minor trade centres as these, partly for lack of demographic data but also because the behaviour of such places is generally thought to be so erratic that pattern-seeking is rendered impossible. Erratic change in post office revenues is not uncommon, but the more general pattern is nevertheless for decline, once initiated, to intensify over time. In relatively few cases is a decade of sharp decline followed by a decade of equally sharp growth (the reverse--growth followed by decline--is much more common and is in keeping with the trend toward centralization in the pattern of trade). The fact that consistent patterns of change can be inferred from the post office revenues of even very small centres provides vindication of the use of the data. These patterns are complex, however, and accurate predictions of rates of growth and decline for individual centres could not be achieved solely by reference to the independent variables employed in this study.

From a philosophical viewpoint, the major deficiency of the initial advantage framework for the investigation of patterns of change is that it does not explicitly incorporate reference to those ongoing processes from which change is derived. A second set of analyses was thus attempted. The impact of certain hypothesized processes relating to changes in the environments of central place systems was modelled; the hypotheses tested were deduced from central place theory and from the developing theory relating to the role of transportation improvements in creating spatial reorganization. Certain problems of operationalization were experienced in the testing of these hypotheses, but these were probably not critical to the success of the analyses. Degree of time-space convergence of places on rival centres was found not to explain rates of change in post office revenue, and there was no evidence to suggest that growing places exert a more deleterious effect on trade in near neighbours than on trade in places situated further away. All hypotheses were rejected. It was concluded that the normative approaches employed were not, in this situation, productive of meaningful generalizations about degree and direction of change in post office revenues.

IMPLICATIONS FOR FUTURE RESEARCH

The frontier of research in human geography passed by the study of central places a decade ago, leaving many cross-sectional studies of the structure of systems of service centres but no integrated theory of their evolution or development. Given that the future growth or decline of trade centres cannot adequately be predicted by reference to the conditions of centres and their environments at single points in time, the necessity for process strategies to be implemented is apparent. The particular strategies employed in this thesis were not successful in explaining even a portion of the variation in rates of change in trade among central places, however, and this finding indicates that alternative approaches should be investigated. Unfortunately, it is difficult to see what alternatives are available for empirical research. The reaction of geography to the failure of normative approaches to provide meaningful explanations of spatial structure has been a refocusing of attention on the behaviour of the actors in spatial systems. Such studies, when directed at processes of change, require that a record of the behaviour of these actors be compiled; clearly this is difficult (if not impossible) in cases where the tempo of change is slow and long periods of time are required for adaptations in spatial structure to be manifested. There is much evidence to suggest that systems of central places respond to collective changes in behaviour on the part of consumers. Interpretative essays which attempt to link change in behaviour and structural alterations to systems are commonplace (an example is Fox, 1962), but formal analyses in which the processes are measured and modelled are rare. Given the difficulties associated with obtaining information on behaviour for times past, future research is likely to continue with the expedient of inferring change in behaviour from alterations in structure. This approach, however, holds little promise of providing major new insights.

Changes in behaviour over short time periods may more fruitfully be investigated, using, for example, "before and after" studies of behaviour when the focus of attention is a major change in the local environment of trade centres. Berry (1960) was able to infer alterations to shopping-trip behaviour in a study of the impact of a new highway bypass on central places. There will be problems of generalizing from short time-spans to longer periods, however. Much inference, based on fragmentary evidence, will be required in further elaborating the link between behavioural process and the structural reorganization of systems.

Difficulties abound, then, in both the normative and the behavioural approaches to the explanation of structural reorganization. For some dimensions of the problem, however, the outlook for normative approaches is not without promise. In the present study an unsuccessful attempt was made to identify competitive impulses radiating spatially from growing places. In this context questions of scale are again germane. Other writers have demonstrated the existence of impulses operating between individual establishments: in a Kentucky study (Stroup and Vargha, 1963) it was shown that when the road network was upgraded, isolated stores close to major centres were earlier forced to close than were those situated at greater distances. The time-periods involved, however, were much shorter than those examined in this thesis, which also considered change not among the individual units of particular functions but only in terms of alterations to the total post office revenues of central places. Further experimentation with data and time-periods of different scales is required.

One further implication of this research should be noted. To the writer's knowledge, no studies have previously been attempted utilizing post office revenue to measure growth and decline among the member places or central place systems. Change in revenue, suitably standardized for the effects of price inflation, provides a measure of the success or failure of the commercial ensemble of a central place in carrying out its function within the space-economy. Moreover this measure is superior to expressions of change derived from population data, not only because it is sensitive to changes in the business carried on in service centres but also because it is less subject to inaccuracy. In Canada, the revenues of post offices are audited on a quarterly basis and are available annually; population data are normally derived only from periodic censuses and are subject to variable degrees of under-enumeration (see Bogue, 1969, pp. 104-06; Winkworth, 1972). Conclusions on the viability of central places in the North American Great Plains, when drawn solely from population data, are apt to be naïvely optimistic (Fuguitt, 1965a; Kale, 1975, p. 39). Many places which continue to grow in population (probably largely as a result of in-migration from their trade areas) are declining in volumes of trade. Where population decline has set in, it is usually anticipated by the onset of a reduction in trade.

SUMMARY

The substantive contribution of this thesis to the literature of spatial reorganization is minor. A central place system based on Red Deer was shown to be undergoing centralization both in the orientation of trade and in the locations of establishments providing goods and services; trade centres are clearly competing amongst each other for custom. In attempting to explain variations in the growth rates of central places, no advance was made on the traditional methods of explanation. The initial advantage approach was, however, shown to have some utility in discerning growth relationships even amongst very small places. Research in the field of change in central place systems has progressed only slowly, and the indications are that the difficulties involved in the modelling of processes will militate against more rapid advances in the future.

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APPENDICES

APPENDIX A

TABLE 1: FUNCTIONAL UNITS PRESENT IN CENTRAL PLACES, RED DEER REGION, 1941

Central Place	Grain Elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear
Cygnet	1																																
Elspeth	1																																
Mintlaw	1																																
Niobe	1																																
Prevo	1																																
Sabine	1																																
Veldt	1																																
Crestomere		1																															
Gwendale		1																															
Homeglen		1																															
New Hill		1																															
Willowdale		1																															
Lamerton	2																																
June	2																																
Oberlin	2																																
Prentiss	2																																
Congresbury						1																											
Dovercourt						1																											
Foreman						1																											
Garrington						1																											
Lobley						1																											
[illegible]						1																											
Nelson Lake						1																											
Sullivan Lake						1																											
Willesden Green						1																											
Equity	3																																
Leahurst	3																																
Netook	1					1																											
Butte		1				1																											
Chedderville		1				1																											
Dickson		1				1																											
Everts		1				1																											
Evergreen		1				1																											
Hillsdown		1				1																											
James R. Bridge		1				1																											
Kevisville		1				1																											
Knee Hill Valley		1				1																											
Perbeck		1				1																											
Springdale		1				1																											
Stauffer		1				1																											
Talbot		1				1																											
Gilby		3																															
Codner	1	1				1																											
Forshee	1	1				1																											
Throne	1	1				1																											
Warden	1	1				1																											
Withrow	1	1				1																											
Eagle Hill		2				1																											
Federal	2	1				1																											
Morningside	2	1				1																											
Brownfield		1				1	1																										
Ardley	1	2				1																											
Leo	1	2				1																											
Bingley						1						1																					
Loyalist	3	1				1																											
Raven		2			1	1																											
Reed Ranch		1						1	1																								
Parmattan		1	1		1	1																											
Fenn	2	1		1		1																											
Crammond		1				1						1																					
Hackett	2	1			1	1																											
Chigwell	2	2				1			1																								
Hespero	2	1				1		2																									
Menaik	2					1		1				1																					
Mulwark	5	1			1	1																											
Leedale		1	1		1	1						1																					
Pine Lake		1				1		1						1																			
Scollard	1	1		1		1		1	1																								
Spruceview		2	1		1												1																
Carlos		1				1						1	1																				

APPENDIX A: Table 1 continued

Central Place	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlor	Men's wear	General hospital	Electrical repair	Farm supplies
Westward Ho		2	1	1	1	1		1																												
Hoadley	1	2	1		1	1					1																									
Fleet	3	2			1	1							1																							
Joffre	3	1		1	1	1							1																							
Haynes	2	2		1	1	1		2																												
Nevis	1	1	1		1	1		2		1																										
Gull Lake	1	1				1		1				2		1																						
Huxley	4	2	1	1	1	1				1	1																									
Tees	2	2	1	1		1			1	1	1	1																								
Lousana	2	3	1		1	1		1	1		1	1																								
Bluffton	1	2		1	1	1	2									1							1													
Botha	4	1	1	1	1	1	1	1		1			1																							
Benalto	4	3	1	1		1	1	1					1	1																						
Alhambra	1	2	1		1	1		1				1															1									
Condor	1	3	3	1	1	1	1	1			1						1																			
Caroline		2	2			1		2			1					1							1													
Blackfalds	2	1	1		1	1		3	2			1		1																						
Markerville		1	1		1	1						1										1						1								
Torrington	4	2	2	2	1	1	1			1	1						1																			
Sundre		2			1	1		3	1		1	1										1														
Red Willow	3	2	1		1	1		1		1		1				1							1													
Rumsey	2	1	1	2	1	1	1		2	1		1		1			1																			
Wimborne	4	2	1	1	1	1	1	1	1		1		1		1		1																			
Penhold	4	2		1		1	1	1	1	1			1	1			1						1													
Leslieville	2	2	1	4	2	1	1		2	1	1	2					1																			
Erskine	3	2	1		1	1	1	1	1	1	1			1			1	1		1																
Byemoor	3	2	1	1	2	1	1	1		3	1	2	1	1																						
Gadsby	3	2	2	3	1	1	1	1	1	2	1	1	1	1		1	1	1					1													
Endiang	3	1	1	3	1	1	1		2	1		1		1		1							1													
Big Valley	1	1	2	3	1	1	2		1	2	1	2		1	1	1	1	1		1	1															
Clive	4	3	2	6	2	1	2	3	2		1		1	1			1	1				1	1													
Veteran	4	3	3	2	1	1	1		1	1	1		1	1	1		1	1			1		1										1			
Elnora	3	2	3	3	1	1	1	3	1	1	2	1	1	1		1	1	1	1			1	1													
Halkirk	3	2	3	2	1	1	1		1		1		1	1		1	2	1		1			1													
Bowden	5	2	4	4	1	1	3		2	2	2	3	1	1	1	1		1				1							1							
Alix	2	3	2	4	1	1	4	3		2	1		1	1	1		1	1		1	1	1		1							1					
Donalda	4	6	2	5	2	1	2		2	2	1		1	1		1	1			1	1	1	1	1					1							
Bentley	3	2	2	2	2	1	2	2	1	2	1		1	1		1	1	1	1	1		1	1	1			1							1		
Alliance	6	2	3	3	1	1	1	2		2	1		1	1	1	1	1	1	1	1	2		1	1							1	1				
Delburne	3	2	3	6	3	1	2	2	2	1	2	1	1	1			2	1		1		1					1				1					
Eckville	4	3	4	5	2	1	3	2	2	2			1	1		1	2	1	1	1	1	1	1	1				1						1		
Mirror	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1		1		1		1					1		1				
Castor	5	3	2	4	3	1	4	1	1	2	2	1	1	1	2	1		1	2	1	1	1	1	1							1	1		1		1
Sylvan Lake	2	3	2	4	4	1	6	4	1	2	2	2	1	1	1	1	1	1		1	1	1		2			1		1	1		1				
Bashaw	3	5	4	4	3	1	2	3		4	1	1	1	1	1	2	2	1	1	1	2	1	1	1	2			1	1		1	1				
Rimbey	3	3	6	6	2	1	2	1	2	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1						1	1	1	1		
Trochu	4	4	3	4	4	1	3		1	1	2		1	1	2	1	1	1	2	1	1			1	1			1	1	1	1	1		1	1	
Rocky Mtn. House	1	2	2	5	3	1	4	2	3	1	2	1	3	2	2	1	2	2	2	2	1	1		1	2	1	1	2		1	1		2	1	2	
Coronation	4	2	2	3	3	1	2	1	1	2	1	2	1	1	1	2	1	1	1	2	1	1		1	1		1		1	1	1	1	1	1	1	
Innisfail	7	3	5	4	7	1	6	3	3	2	1	4	2	1	3	2	1	2	2	1	3	1	1	1	2	2	1	3		1	1	1	1	1	1	2
Olds	8	3	10	5	5	1	6	5	5	4	4	2	3	1	6	2	2	2	4	2	2	1	1	1	1	1	2	1	3	1	1	1		1	1	1
Stettler	4	2	8	7	6	1	6	1	2	1	3	2	2	2	3	3	2	3	5	3	4	3	1	2	1	4	2		1	2	1	1	2	1	1	1
Lacombe	3	3	8	5	5	2	6	6	6	3	3	3	2	2	3	3	1	2	4	3	2	2	3	1	2	4	1	1	2	2	1		2	1	1	1
Ponoka	5	2	11	6	4	1	5	8	4	2	4	6	1	2	4	3	1	2	2	2	1	2	2	1	2	3	2	2		1	1	2	3		2	1
Red Deer	5	1	10	6	9	1	9	8	10	4	4	5	6	3	7	5	1	4	5	4	3	3	1	2	3	4	3	3	3	3	1	1		2	2	2
TOTAL	213	173	136	126	110	104	99	91	73	63	59	50	45	43	43	41	40	37	37	33	31	26	22	21	19	19	17	16	15	15	15	14	13	13	12	11

SOURCE: See text pp. 70-75.

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Automobile sales	41
Shoe repair	40
Pool hall	37
Drugstore	37
Physician	33
Bank	31
Legal services	31
Creamery	28
Saddlery	27
Bakery	21
Jewellery	19
Beauty salon	19
Women's wear	17
Household appliances	16
Insurance	16
Furniture	16
Less-than-daily newspaper	15
Funeral parlour	14
Men's wear	13
General hospital	13
Electrical repair	12
Farm supplies	11
Dentist	11
Tailor	11
Dry cleaning	10
Shoe shop	8
Variety store	8
Dry goods	7
Auto. accessories	7
Photographic studio	6
Chiropractor	5
Liquor outlet	4
District agriculturalist	4
Library	3
Family wear	3
Confectionery	3
Specialized auto. repair	3
Department store	2
Accounting	2
Optician	2
Veterinarian	1
Children's wear	1
Furnishings	1
Florist	1
Book shop	1
Psychiatric hospital	1
Tertiary education	1

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APPENDIX A

TABLE 2: FUNCTIONAL UNITS PRESENT IN CENTRAL PLACES, RED DEER REGION, 1961

Central Place — Functions

Central Place	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor	Liquor outlet	District agriculturalist
Cygnet																																																	
Elspeth	1																																																
Mintlaw	1																																																
Niobe	1																																																
Prevo	1																																																
Sabine	1																																																
Veldt	1																																																
Crestomere		1																																															
Gwendale		1																																															
Homeglen		1																																															
New Hill		1																																															
Willowdale		1																																															
Lamerton	2																																																
June	2																																																
Oberlin	2																																																
Prentiss	2																																																
Congresbury																																																	
Dovercourt						1																																											
Foreman																																																	
Garrington																																																	
Lobley																																																	
Mound						1																																											
Nelson Lake																																																	
Sullivan Lake						1																																											
Willesden Green																																																	
Equity	3																																																
Leahurst	3																																																
Metook	1					1																																											
Butte		1				1																																											
Chedderville		1				1																																											
Dickson		1				1																																											
Evarts		1				1																																											
Evergreen		1				1																																											
Hillsdown		1				1																																											
James R. Bridge		1				1																																											
Kevisville		1				1																																											
Knee Hill Valley		1				1																																											
Perbeck																																																	
Springdale		1																																															
Stauffer		1				1	1																																										
Talbot		1				1																																											
Gilby		1																																															
Codner	1	1				1																																											
Forshee	1	1				1																																											
Throne	1	1				1																																											
Warden	1	1				1																																											
Withrow	1	1			1	1																																											
Eagle Hill		2				1																																											
Federal	2	1				1																																											
Morningside	2	1				1																																											
Brownfield		1				1																																											
Ardley	1	2				1																																											
Leo	1	1				1																																											
Bingley						1						1																																					
Loyalist	2	1				1																																											
Raven		2			1	1																																											
Reed Ranch		1						1	1																																								
Harmattan		2	1		1	1																																											
Fenn	2	1			1	1																																											
Crammond		1				1																																											
Hackett	2	1			1	1		1																																									
Chigwell	2	1				1		1	1																																								
Hespero	2	1	1			1		2				1																																					
Menaik	2					1		1				1																																					
Bulwark	5	1				1																																											
Leedale		1				1		2				1																																					
Pine Lake		1			1	1		1				1		1																																			
Scollard	1	1				1																																											
Spruceview		1	1				1						1				1																																
Carlos						1							1																																				

1 of

Jewellery Beauty salon Women's wear Household appliances	Insurance Furniture Less-than-daily newspaper Funeral parlour Men's wear General hospital Electrical repair	Farm supplies Dentist Tailor Dry cleaning Shoe shop Variety store Dry goods	Auto. accessories Photographic studio Chiropractor Liquor outlet District agriculturalist Library Family wear	Confectionery Specialized auto. repair Department store Accounting services Optician Veterinarian Children's wear	Furnishings Florist Bookshop Psychiatric hospital Tertiary education Sporting goods Physiotherapist	Fuel Upholstery repair Nursing home Motorcycles Music store Car rental Monuments

DOMTAR

2of2

APPENDIX A: Table 2 continued

Central Place	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drug store	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio
	Functions																																											
Westward Ho		2	1	1	1	1		1																																				
Hoadley.	1	2	2		1	1			1	1																																		
Fleet	3	2			1	1							1																															
Joffre	3	1			1	1	1																																					
Haynes	2	1	1	1	1	1		1																																				
Nevis	1	2			1	1		1																																				
Gull Lake	1	1				1						2																																
Huxley	4	1	1	1		1				1		1																																
Tees	2	1	1		1	1		1	1			1																																
Lousana	2	2	1		1	1		1	1			1					1																											
Bluffton	1	2		1		1	1	2						1			1																		1									
Botha	4	1	1	1		1	1	1		1			1																1															
Benalto	4	2	1		1	1		2			1		1	1						1															1									
Alhambra	1	2	3		1	1		1																																				
Condor	1	2	1		1	1	2	1		1		1	1																															
Caroline	2					1	1	1	2	1			1	1		1	1							1																				
Blackfalds	2	1	1		1	1		3	1	1			1	1		1																												
Markerville		1	1		1	1						1										1																						
Torrington	4	2	2	1		1	1	1	1		1		1				1	1																	1									
Sundre		2	2	2		1	2	3	1	2	1	1	1	1	1	1				1		1		1												1								
Red Willow	3	1		1		1	2	2	1	1						1																												
Rumsey	2	2	2	2	1	1		1	2	1				1			1																											
Wimborne	4	2	1	[illegible]		1	1	2	1		1		1				1																											
Penhold	4	1	[illegible]	[illegible]	1	1	2	4	1	1	1	1	1	1			1																											
Leslieville	2	1	1	3	1	1	1		2	1	1	1		[illegible]			1																											
Erskine	3	1	1			1	1	1	1	1		1		1		1	1	1					1																					
Byemoor	3	2	1	2	2	1	1	1	2	3	1	1	1	1	1																													
Gadsby	3	2	4	3	1	1	1	1	2	1	1		1	1		1		1																										
Endiang	3	1	1	1	1	1	1		1	1		1																					1							1				
Big Valley	2	2	2	4	1	1	2	1	1	1	1	1		1	2	1	1	1		1	1																							
Clive	4	3	2	2	1	1	3	5	2		1		1	1			1	1		1		1							1															
Veteran	3	3	2	5		1	2		1	1	1		2	1	1		1			1	1								1															
Elnora	1	3	1	4	1	1	2	3	2		1		1	1	1		1	1	1	1		1				1			1					1										
Halkirk	3	1	2	1	2	1	1	1	1	1	1		1	1	1		1			1								1																
Bowden	5	2	1	3	1	1	2	4	2	2	1		1	1	2	1		1	1	1		1													1									
Alix	2	2	2	3	2	1	2	2		2	1	1	1	1	1		1	1		1	1	1				1	1			1	1		1								1			
Donalda	4	3	2	4		1	3	2	2	1	1	1	1	1	1		1			1		1							1															
Bentley	3	3	2	5	1	1	1	3	2	3	1		2	1	1		1	1	1	1		1		1			2		1					1	1	1								
Alliance	6	2	2	5	1	1	1		1	2	1		1	1	2	1	1	1	1	1	1		1	1	1			1	1		1	1												
Delburne	3	3	2	4	1	1	3	2	1	1	1	1	1	1	1	1	1	1		1		1				1			2		1				1						1			
Eckville	4	3	5	5	3	1	3	1	3	2		1	2	1	1			1	1	2	1	1		1		1	1	1	1				1	1	1	1								
Mirror	1	2	1		1	1	1	3	1	1	2	1	1	1	1	1	1	1	1		1			1			1			1		1	1											
Castor	5	1	4	7	2	1	2	3	2	3	3	2	1	1	4	2	1	1	2	1	1	1		1	1		1	1		1	1			1		1		1			1			
Sylvan Lake	2	2	4	1	2	1	7	6	1	1	2	4	2	1	1	1	1	1	2	1	1	1		1	1	1	2	2	3	1	1	1			1	1						1		
Bashaw	4	5	5	4	2	1	2	1	2	3	2	2	1	1	4	1	1	1	1	1	1	1		1	1	[illegible]	[illegible]	1	2		1					1				1	1			
Rimbey	5	3	5	6	5	1	3	2	3		1	2	2	1	2	1		1	2	2	1	1		1	2	[illegible]	[illegible]	1	1	1	1	1	1	2	1	1	1				1		1	1
Trochu	4	2	5	4	2	1		3	2	1	2	2	1	1	4	1	1	1	1	1	1				1			2	1		1			1	2		1	1				2		1
Rocky Mtn. House	1	3	6	5	1	1	5	4	3	1	2	1	4	2	6	2	1	2	3	2	1	1		2	2	1		2	2	1	1	1	1	1	2		1		2		1			
Coronation	4	4	4	5	1	1	5	1	3	3	1	3	1	1	3	1	1	1	1	2		1		1	1			[illegible]	1		1			1	1				1		1		1	
Innisfail	7	5	7	6	4	1	4	7	3	4	1	5	2	1	6	1	1	2	3	2	3	1		1	2	2	1	2	4	3	1	1	1	1	1	1	1		2		1	1	2	
Olds	8	4	7	7	5	1	7	9	5	6	3	2	4	1	6	2	1	2	3	3	1	1	1	1	2	2	2	2	6	1	1	1	1	1	2	1	2	2	2		1	1	1	1
Stettler	4	1	11	7	3	1	4	4	5	2	3	5	2	2	8	1	1	3	4	3	3	2	1	3	2	5	2	3	5	3	1	1	2	1	1	1	1		4	2	1	1	1	3
Lacombe	3	2	7	7	4	2	6	7	6	4	5	3	2	2	6	2	2	2	9	3	3	1		2	2	3	5	4	5	3	1	1	2	1	2	3	2		1	2	4	2	2	1
Ponoka	5	4	8	9	4	1	7	6	5	2	3	4	2	2	8	2	1	3	6	3	2	1		1	2	3	3	3	6	2	1	1	3	1	2	2	2	1	3		2	1	1	1
Red Deer	5	2	14	10	11	1	15	8	8	4	4	9	6	4	10	3	2	3	15	6	5	2	1	2	5	5	6	8	23	8	1	1	3	1	6	2	4	3	5	3	3	2	8	3
TOTAL	211	160	145	146	89	97	114	128	90	68	54	68	57	45	86	31	35	36	37	45	29	24	5	23	25	29	30	35	69	26	16	11	18	15	28	19	15	8	20	9	19	11	17	11

SOURCE: See text pp. 70-75.

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	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor	Liquor outlet	District agriculturalist	Library	Family wear	Confectionery	Specialized auto. repair	Department store	Accounting services	Optician	Veterinarian	Children's wear	Furnishings	Florist	Bookshop	Psychiatric hospital	Tertiary education	Sporting goods	Physiotherapist	Fuel	Upholstery repair	Nursing home	Motorcycles	Music store	Car rental	Monuments
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	1	1	1	2	2	3	1	1	1			1	1						1						1		1			1			1														
	1	1			1	2		1					1				1	1												1																	
	1	2	2	2	1	1	1	1	1	1	2	1	1	1				1		1	1							1					1														
		1	1		2	1		1			1	2		1	1				2		1						1																				
	2	2	1		2	2	1	1	1	1	1	2		1		2		1					1					1												1							
	1	1			1	1		1			1	1				1		1		1			1		1	1		1		1																	
	1	2	2	1	2	4	3	1	1	1	1	1	1	1		2		1	1	2			1			1	1	2																			
1	1	2	2	2	2	6	1	1	1	1	1	2	1	2	2	2		1	1	1	1	1		1			1	2				1	1					1	1								
1	3	2	5	3	3	5	3	1	1	2	1	1	1	1		4	2	1	1	1	3	3	1	1	1			2	2	1	1	1			1												
	2	2	3	5	4	5	3	1	1	2	1	2	3	2		1	2	4	2	2	1	2	1	1	1	1		1	1	1	1	2			1												
	1	2	3	3	3	6	2	1	1	3	1	2	2	2	1	3		2	1	1	1			1	1		1	1		1					1		1										
1	2	5	5	6	8	23	8	1	1	3	1	6	2	4	3	5	3	3	2	8	3	2	1	1	1	1	1	7	2	5	3	1	1	1	2	2	1		1	1	3	1	1	2	1	1	2
5	23	25	29	30	35	69	26	16	11	18	15	28	19	15	8	20	9	19	11	17	11	8	6	5	11	6	6	19	5	11	5	5	5	2	5	2	2	1	2	2	3	1	1	2	1	1	2

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APPENDIX A

TABLE 3: FUNCTIONAL UNITS PRESENT IN CENTRAL PLACES, RED DEER REGION, 1961

Functions

Central Place	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty Salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio
Cygnet																																												
Elspeth	1																																											
Wintlaw	1																																											
Niobe	1																																											
Prevo	1																																											
Sabine	1																																											
Veldt	1																																											
Crestomere		1																																										
Gwendale		1																																										
Hanneglen		1																																										
New Hill		1																																										
Willowdale																																												
Lamerton	2																																											
June	2																																											
Oberlin	2																																											
Prentiss	2																																											
Congresbury																																												
Dovercourt						1																																						
Foreman																																												
Garrington																																												
Lobley																																												
Mound																																												
Nelson Lake		1																																										
Sullivan Lake																																												
Willesden Green																																												
Equity	3																																											
Leahurst	2																																											
Netook	1																																											
Butte		1				1																																						
Chedderville		1				1																																						
Dickson		[illegible]				1					1																																	
Evarts		1				1																																						
Evergreen		1				1																																						
Hillsdown		1				1																																						
James R. Bridge		1				1																																						
Kevisville		1				1																																						
Knee Hill Valley						1																																						
Purbeck																																												
Springdale																																												
Stauffer		1				1																																						
Talbot		1				1																																						
Gilby		1																																										
Codner	1	1																																										
Forshee	1	1				1																																						
Throne	1	1				1																																						
Warden	1					1																																						
Withrow	1					1																																						
Eagle Hill		2				1																																						
Federal	2	1				1																																						
Morningside	2	1				1																																						
Brownfield		1				1	1																																					
Ardley	1	1				1																																						
Leo	1																																											
Bingley						1						1																																
Loyalist	2	1				1																																						
Raven		1			1	1																																						
Reed Ranch		1						1	1																																			
Harmattan		1	1		1	1																																						
Fenn	2	1			1	1																																						
Crammond		1				1																																						
Hackett	2																																											
Chigwell	2	1				1		1	1																																			
Hespero	2		1					1				1																																
Menaik	2					1		1				1																																
Bulwark	4	1				1																																						
Leedale		1				1																																						
Pine Lake		1			1	1		2						1																														
Scollard	1	1				1																							1															
Spruceview		1	1				2	1	1								1																											
Carlos						1																																						

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Bakery							
Jewellery							
Beauty Salon							
Women's wear							
Household appliances							
Insurance							
Furniture							
Less-than-daily newspaper							
Funeral parlour							
Men's wear							
General hospital							
Electrical repair							
Farm supplies							
Dentist							
Tailor							
Dry cleaning							
Shoe shop							
Variety store							
Dry goods							
Auto. accessories							
Photographic studio							
Chiropractor							
Liquor outlet							
District agriculturalist							
Library							
Family wear							
Confectionary							
Specialized auto. repair							
Department store							
Accounting services							
Optician							
Veterinarian							
Children's wear							
Furnishings							
Florist							
Bookshop							
Psychiatric hospital							
Tertiary education							
Sporting goods							
Physiotherapist							
Fuel							
Upholstery repair							
Nursing home							
Motorcycles							
Music store							
Car rental							
Monuments							

BELL-FAST BOND
50% COTTON

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APPENDIX A: Table 3 continued

Central Place	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories
Westward Ho		2	1		1	1		1																																			
Hoadley		2			1	1		1	1	1																																	
Fleet	3	1				1																																					
Joffre	3	1				1																																					
Haynes	2	1	1			1		1																																			
Nevis	1	2				1	1	1																																			
Gull Lake	1	1										2																															
Huxley	4	1	1	1		1			2																																		
Tees	2	1				1		1	1		1	1																															
Lousana	2	2	1			1		1	1			1																															
Bluffton	1	1				1	1	1														1												1									
Botha	4	1	1			1	1	2	1				1																														
Benalto	4	1	1		1	1		3	1			1	1	1																				1									
Alhambra	1	1				1		1	1																																		
Condor	1	1				1	1	1	1			1																															
Caroline		1	2			1	1	1	1				1	1																													
Blackfalds	2			2	1	1	4	4	2	1		1	1	1			1			1																							
Markerville		1	1		1	1			1													1																					
Torrington	4	2	1	1		1	2	3	2	1			1	1			1																	1									
Sundre		2	2	3	1	1	3	5	3	2	1	1	1	1	1	1				1		1		1	1	1		1	2					1	1				1	1			
Red Willow	3		1	1		1	1			1																																	
Rumsey	2	2			1	1	1	2	2	1				1			1																										
Wimborne	4	1	1	2		1		1	2				1				1																										
Penhold	4	1		1		1	1	6	1	1		1	1																1							1							
Leslieville	2	2	1	1		1		1	1	1	1	1		1																													
Erskine	2	1	1			1	2	1		1		1					1	1																									
Byemoor	3	1	1	1	1	1	1	1	2	1		1		1																						1							
Gadsby	3			1		1		2	1	1		1	1					1																									
Endiang	3	1		1	1	1		1				1																					1										
Big Valley	2			2	1	1	2	1	3	1	1	2	1	1		1	1			1																					1		
Clive	4	2	1	1		1	1	4	2				1	1				1											1														
Veteran	3	3	3	3		1			1		1		1	1	1		1			1	1																						
Elnora	3	2	2	3	1	1	1	4	3	1	1		1	1	1		1		1	1		1							1					1							1		
Halkirk	3	2	1	2		1	1	2	1	1	1		1	1						1																							
Bowden	4	1	2	2		1	4	6	3	1	1	1	1	1	3		1			1		1		1			1		1				1										
Alix	2	3	2	4	2	1	1	2	2	1	1		1	1	2		1	1		1		1				1	1		1		1										1		
Donalda	4	1	1	4	2	1	3	1	2	2	1	1	1	1	1		1			1		1							1							1							
Bentley	3	3	2	5	2	1	1	3	3	3	1		1	1	1			1	1	1		1		1					1					1	1	1					1		1
Alliance	7	2	3	4		1	2		2	2	1		1	1	1		1	1	1	1				1							1												
Delburne	3	2	2	6	2	1	3	5		1	1	1	1	1	1		1	1		1		1							2		1				1	1					1		
Eckville	4	3	3	4	1	1	2	5	4	2			1	1	1			1	1	2	1	1		1	1	1	1	2	2				1	1	1	1							
Mirror	1	2	1			1	2	3	2		1			1							1							1															
Castor	6	1	5	5	1	1	2	3	2	3	2	2	2	1	3	1		1	2	1	1	1		1	1	1	1	1	1	1	1	1		1	1						1		1
Sylvan Lake	2	3	2	3		1	5	5	2	2	1	2	1	1	1		1	1	1	1		1		2	1	2		2	3	3	1	1			1						1		
Bashaw	4	3	3	5	2	1	1	2	2	2	1	1	1	1	2		1	1	1	1	1	1		1	1			1	3		1					1					1		
Rimbey	3	5	4	7	2	1	4	2	3	2	1	2	2	1	4	1	1	2	2	2		1		2	1	2	1	2	1	1	1	1	2	2	1	1	1				1	1	1
Trochu	4	3	4	5	2	1	1	2	4		1	2	1	1	4	1	2	1		1	1				1	2		2	1	1	1	1	1	1	3	1	1	1					
Rocky Mtn. House	1	6	6	4	5	1	4	8	3	2	2	2	3	2	5		2	1	3	2		1		1	2	2	1	3	6	2	1	1	1	1	3	1	1				1		
Coronation	5	1	3	6		1	3	3	5	2		2	1	1	3	1	1	1	2	2	1	1			1	1	1	1	1		1	1		1	2		1		2		1		
Innisfail	7	3	4	6	5	1	6	7	7	4	1	4	2	1	6	1	1	2	5	3	2	1		1	2	1	1	2	2	3	1	1	1	1	1	3	1		1	1	1	1	2
Olds	8	4	5	6	2	1	9	11	6	3	3	3	6	2	7	1	1	2	4	3	2	1		1	3	2	2	2	6	2	1	1	2	1	3	2	2	1	2	1	1	3	2
Stettler	4	7	7	8	4	1	6	9	8	3	4	5	5	2	7	1	1	3	6	3	3	1		3	2	4	3	4	5	5	1	2	3	2	2	2	3		3	1	3	2	6
Lacombe	3	1	5	10	2	2	6	8	6	4	3	5	3	2	5	2	1	3	6	3	2	1		3	3	3	2	4	4	4	1	1	2	1	3	3	2		2	1	1	4	3
Ponoka	5	3	10	6	2	1	7	8	3	3	2	6	5	2	7	1	1	2	6	3	2	1		3	2	3	3	2	10	4	2	1	4	1	2	2	2		3	1	5	2	3
Red Deer	5	1	19	12	6	3	23	27	9	6	5	10	7	4	16	3	3	5	19	9	5	3		2	7	12	6	10	35	8	1	2	5	1	5	3	9	2	7	6	4	2	3
TOTAL	208	132	120	138	57	55	122	179	118	63	41	68	59	43	83	15	30	34	62	48	23	25	0	25	29	38	24	48	90	34	17	14	24	16	34	26	23	4	20	11	26	17	21

SOURCE: See text pp. 70-75

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Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor	Liquor outlet	District agriculturalist	Library	Family wear	Confectionery	Specialized auto. repair	Department store	Accounting services	Optician	Veterinarian	Children's wear	Furnishings	Florist	Bookshop	Psychiatric hospital	Tertiary education	Sporting goods	Physiotherapist	Fuel	Upholstery repair	Nursing home	Motorcycles	Music store	Car rental	Monuments	Trailer homes	Travel agency	Employment agency	Daily newspaper	Pet shop	Secretarial college
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					1													1																													
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3	3	1	1			1						1					1			1	1																										
3		1					1					1					1		1		1	1		1																							
1	1	1	1	2	2	1	1	1				1	1	1	1		1					1				1																					
1	1	1	1	1	1	3	1	1	1						1		1		1							1							1														
4	2	1	1	1	1	3	1	1				1	1		1		1	1			1	1	1	2			1																				
1		1	1		1	2		1		2		1			1		1		1	1						1									1												
2	3	1	1	1	1	1	3	1		1	1	1	1	2	1		1	1		1	1	1		1		1											1										
6	2	1	1	2	1	3	2	2	1	2	1	1	3	2	1	1	1	1	1			3	1	2		1	1		1			1	1				1	1									
5	5	1	2	3	2	2	2	3		3	1	3	2	5	1	3	1	1	1			8	2	1	1	1		2	1	1			2		1	1			1			1					
4	4	1	1	2	1	3	3	2		2	1	1	4	3	1	2	1	1	2			3	1	1	2	2	1		1				1		1	1											
10	6	2	1	4	1	2	2	2		3	1	2	2	3	1		1	1	[illegible]			2	2	1	1	1	2		2	1	1				1												
35	8	1	2	5	1	5	3	9	2	7	5	4	2	3	3	2	3	1	1	1		10	3	6	5	2	4	4	3	5	1		3	2	1	1	2	1	1	2	1	6	1	1	1	1	1
90	34	17	14	24	16	34	26	23	4	20	11	24	17	21	12	8	15	7	12	5	4	31	10	15	9	12	11	6	8	7	2	1	9	2	5	3	4	2	2	2	1	8	1	1	1	1	1

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APPENDIX A

TABLE 4: FUNCTIONAL UNITS PRESENT IN CENTRAL PLACES, RED DEER REGION, 1977

Central Place	Functions																																													
	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor	Liquor outlet	District agriculturalist
Cygnet																																															
Elspeth																																															
Mintlaw																																															
Niobe	1																																														
Prevo																																															
Sabine	1																																														
Veldt																																															
Crestomere		1																																													
Swendale		1																																													
Homeglen																																															
New Hill																																															
Willowdale																																															
Lamerton																																															
June	2																																														
Oberlin	1																																														
Prentiss	2																																														
Congresbury																																															
Dovercourt																																															
Foreman																																															
Garrington																																															
Lobley																																															
Mound																																															
Nelson Lake		1																																													
Sullivan Lake																																															
Willesden Green																																															
Equity	3																																														
Leahurst																																															
Netook																																															
Butte		1																																													
Chedderville																																															
Dickson		1									1																																				
Everts																																															
Evergreen		1																																													
Hillsdown		1																																													
James R. Bridge		1				1																																									
Kevisville																																															
Knee Hill Valley																																															
Purbeck																																															
Springdale																																															
Stauffer		1				1																																									
Talbot		1																																													
Gilby		1																																													
Codner	1																																														
Forshee	1	1																																													
Throne		1				1																																									
Warden																																															
Withrow	1																																														
Eagle Hill		1																																													
Federal																																															
Morningside		1				1																														1											
Brownfield		1				1	1																																								
Ardley	1																																														
Lee																																															
Bingley												1																																			
Loyalist	2																																														
Raven		1			1	1																																									
Reed Ranch		1						1	1																																						
Harmattan			1		1																																										
Fenn		1			1																																										
Cremond		1																																													
Hackett	1																																														
Chigwell	2	1																																													
Hespero	2		1					1																																							
Menaik	2					1						1																																			
Bulwark																																															
Lendale		1																																													
Pine Lake		1				1	1	1						1															1																		
Scollard	1																																														
Spruceview		1					1	1	1																	1																					
Carlos																																															

1 of

Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor	Liquor outlet	District agriculturalist	Library	Family wear	Confectionery	Specialized auto. repair	Department store	Accounting services	Optician	Veterinarian	Children's wear	Furnishings	Florist	Bookshop	Psychiatric hospital	Tertiary education	Sporting goods	Physiotherapist	Fuel	Upholstery repair	Nursing home	Motorcycles	Music store	Car rental	Monuments
											1																																		
	1			1																										1															

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APPENDIX A: Table 4 continued

Central Place

Functions

	Grain elevator	General store	General auto. repair	Farm equipment	Machine shop	Post office	Restaurant	Service station	Bulk oil	Hardware	Meat market	Grocery	Building materials	Hotel with bar	Automobile sales	Shoe repair	Pool hall	Drugstore	Physician	Bank	Legal services
Westward Ho		2	1					1													
Hoadley		1	1																		
Fleet	3	1				1															
Joffre	3	1																			
Haynes	2	1	1					1													
Nevis		1				1	1														
Gull Lake		1					1					2									
Huxley	4	1	1	1		1			2												
Tees	2					1						1									
Lousana	2	1				1	1	1	1												
Bluffton		1				1		1	1												
Botha	3	1				1	1														
Benalto	4	1				1		1	1	1				1							
Alhambra	1	1				1		1	1												
Condor	1					1	1	1				1	1								
Caroline		1	1		1	1	1	3	1				2	1							
Blackfalds	2	1				1	1	3	1	1		1	1	1							
Markerville		1	1		1	1			1												
Torrington	4	2				1	1	1	1	1				1							
Sundre	[illegible]	2	2	1	2	1	2	4	3	3		3	2	1	1			1	2	2	
Red Willow	3					1															
Rumsey	2	1				1		1	1	1		2		1			1				
Wimborne	4	1	1	1		1		1	1				1				1				
Penhold	4	1		1	1	1	1	3	2	1			1	1							
Leslieville	2	2				1		2	1	1				3							
Erskine	2	1				1	1	2													
Byemoor	3	1	1	1	1	1		1	2					1							
Gadsby	3			1		1		1					1								
Endiang	3	1		1		1		1				1									
Big Valley	2					1	2	1	2	1		1	1	1						1	
Clive	4	1	2			1		3	1	1			1	1							
Veteran	3	3	1	1		1		2	1		1		1	1							1
Elnora	3	2	2	2	1	1		2	2		1		1	1	1					1	
Halkirk	4	2	1			1		2	1		1		1	1						1	
Bowden	4	1	2	1		1	3	2	1	1		1	1	1	1					1	
Alix	2	3	2	2	3	1		4	2	1	1		1	1	1				1	1	
Donalda	4	1	1	1		1		2	2	1		1		1						1	
Bentley	3	3	2	2	2	1	1	2	2	1	1		1	1	1			1	1	1	
Alliance	7	1	2	1		1	1		2	2	1	1		1	2			1	1	1	
Delburne	3	2	3	1	1	1	1	3	2	1	1		1	1	1			1		1	
Eckville	4	1	2	5	2	1	1	3	2	3		1		1	1			1	1	2	
Mirror	1	2	1			1		3			1			1							
Castor	5	1	[illegible]	3	2	1	1	3	2	2	2	2	2	1	2			1	3	2	
Sylvan Lake	3	1	2		2	1	5	5	1	2		1	1	1	1			1	1	1	
Bashaw	4	2	2	3	2	1	1	4	2	3	1	2	1	1	2			1	2	2	1
Rimbey	1	5	5	4	3	1	2	6	4	3	1	2	2	1	2		1	1	3	2	1
Trochu	4	2	3	4	1	1	2	2	3	2	1	2	1	1	3		1	1		1	1
Rocky Mtn. House		4	7	4	4	1	7	8	5	5	2	3	3	2	5		1	2	3	4	2
Coronation	4	5	1	6	1	1	2	3	3	1	1	1	1	1	1	1	1	1	1	2	1
Innisfail	8	2	3	5	4	1	7	6	5	2	3	4	1	1	4	2		2	8	3	1
Olds	9	3	6	8	3	1	11	10	7	3	3	2	2	2	4	1	1	2	6	4	3
Stettler	4	2	10	9	4	1	7	8	6	2	3	4	4	2	7			3	7	4	2
Lacombe	3	2	10	4	2	2	5	8	3	6	2	6	2	2	4	1	1	3	7	3	2
Ponoka	6	3	6	3	3	1	5	11	4	3	1	7	3	2	4		1	6	7	4	3
Red Deer	5	2	20	11	9	4	25	32	14	5	4	13	5	6	14	2	2	7	30	9	9
TOTAL	181	109	111	88	58	61	104	169	101	60	33	67	46	46	62	7	11	34	84	54	27

	Creamery	Saddlery	Bakery	Jewellery	Beauty salon	Women's wear	Household appliances	Insurance	Furniture	Less-than-daily newspaper	Funeral parlour	Men's wear	General hospital	Electrical repair	Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor
Westward Ho																								
Hoadley																								
Fleet																								
Joffre																								
Haynes																								
Nevis																								
Gull Lake																								
Huxley																								
Tees																								
Lousana																								
Bluffton															1									
Botha																								
Benalto								1							1									
Alhambra																								
Condor																								
Caroline					1																			
Blackfalds																				1				
Markerville	1				1																			
Torrington																								
Sundre	1		1	1	1	1	1	1	1	1		1	1	3	1			1		1		1		
Red Willow																								
Rumsey																								
Wimborne																								
Penhold								1							1									
Leslieville																								
Erskine																								
Byemoor																				1				
Gadsby																								
Endiang																								
Big Valley								1												1				
Clive								1																
Veteran					1			1												1				
Elnora							1	1					1		1					1				
Halkirk																								
Bowden					1	1		1	1			1			1							1		
Alix	1				2			2							2					1				
Donalda	1														1									
Bentley	1		1		1			1					1	1	1					1				
Alliance										1														
Delburne					1		1	3		1				1	1			1		2				
Eckville			1	1	4		3	2		1			1		1									
Mirror																								
Castor	1		1	1	1	1	2		1	1	1		1	1	1			1		1		1		
Sylvan Lake	1		1	1	2		1	3	1	1	1			1						1				
Bashaw	1		1		2		1	2		1		1	1	1	2					1		1		1
Rimbey	1		1	1	2	2		2	1	1		2	2	1				1		2	1	1	1	1
Trochu				1	1		2	1	1	1		1	1	1	1	1			1	1		1	1	
Rocky Mtn. House	1		1	2	3	2	4	6	2	1		2	1	3	2	1	1	3		1		4		1
Coronation				1	3	2	3	1		1	1	1	1	3	1			1	1	1		1		
Innisfail	1		3	1	3	1	3	4	1	1	1	2	1	2	3	1		2	1	1	1	2	1	1
Olds	1		2	2	4	4	3	8	4	1	1	2	1	2	2	2		2	1	1	1	4	1	2
Stettler	1		2	2	7	4	4	10	2	1	1	2	2	2	2	3		2	3	2	1	3	1	2
Lacombe	1		2	2	3	2	4	7	4	1	2	2	1	1	3	3		2	1	2	2	3	1	2
Ponoka			2	3	4	3	3	7	3	2	1	3	1	3	2	3		2	1	2	2	4	1	1
Red Deer	3		2	4	21	8	8	49	9	1	1	8	2	6	3	14	2	5	5	2	2	9	4	6
TOTAL	17	0	21	23	70	31	44	117	31	18	10	28	19	32	35	28	3	23	14	29	10	36	11	17

SOURCE: See text pp. 70-75.

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Farm supplies	Dentist	Tailor	Dry cleaning	Shoe shop	Variety store	Dry goods	Auto. accessories	Photographic studio	Chiropractor	Liquor outlet	District agriculturalist	Library	Family wear	Confectionery	Specialized auto. repair	Department store	Accounting services	Optician	Veterinarian	Children's wear	Furnishings	Florist	Bookshop	Psychiatric hospital	Tertiary education	Sporting goods	Physiotherapist	Fuel	Upholstery repair	Nursing home	Motorcycles	Music store	Car rental	Monuments	Trailer homes	Travel agency	Employment agency	Daily newspaper	Pet shop	Secretarial college	Equipment rental	Toy shop	Antiques	Camera shop	Health foods	Marriage counselling
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1			1		1		1					1			2	1										1				1	1															
					1					1			1								1					1				1																
2					1		1		1	1		1					1		1											1																
			1		2	1	1	1	1	1					3	1	1		1									1			1															
1	1			1	1		1	1		1		1			1				1									1																		
2	1	1	3		1		4		1	1	1		1	1	3	2	3	1	1	1		1				3		2		1					1						1					
1			1	1	1		1			1	1	1																																		
3	1		2	1	1	1	2	1	1	1			1	1	2		1	1	1			1				1	1			1																
2	2		2	1	1	1	4	1	2	1	1	1		2	3	2	2	1	1	2		2	1		1	1	1	1		1	1											1				
2	3		2	3	2	1	3	1	2	1	1	1			7	2	2	2			4	2	1			2		2	2	1	1	1			3	1	1				1					
3	3		2	1	2	2	3	1	2	1	1	2		2	4	2	1	2	1			1	1			1	1	2	1	1	1					1										
2	3		2	1	2	2	4	1	1	1	1	1		1	1	3	1	1	2			3	1	1				1	1	2																
3	14	2	5	5	2	2	9	4	6	3	2	1	2	1	13	4	11	8	4		6	5	5	1	1	8	3	2	4	5	2	3	5	2	6	1	1	1	1	1	4	1	1	1	1	1
35	28	3	23	14	28	10	36	11	17	17	8	12	6	8	41	17	24	16	15	4	11	15	9	2	2	20	6	14	8	15	7	5	5	2	11	3	2	1	1	1	6	2	1	1	1	1

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APPENDIX B

FUNCTIONAL SCORES AND HIERARCHICAL LEVELS OF CENTRAL PLACES, RED DEER REGION, 1941-1971

	Functional Score				Hierarchical Level			
Central Place	1941	1951	1961	1971	1941	1951	1961	1971
Cygnet	0.47				1			
Elspeth	0.47	0.47	0.48		1	1	1	
Mintlaw	0.47	0.47	0.48		1	1	1	
Niobe	0.47	0.47	0.48	0.55	1	1	1	1
Prevo	0.47	0.47	0.48		1	1	1	
Sabine	0.47	0.47	0.48	0.55	1	1	1	1
Veldt	0.47	0.47	0.48		1	1	1	
Crestomere	0.58	0.58	0.58	0.58	1	1	1	1
Gwendale	0.58	0.58	0.58	0.58	1	1	1	1
Homeglen	0.58	0.58	0.58		1	1	1	
New Hill	0.58	0.58	0.58		1	1	1	
Willowdale	0.58	0.58			1	1		
June	0.94	0.94	0.96	1.10	1	1	1	1
Lamerton	0.94	0.94	0.96		1	1	1	
Oberlin	0.94	0.94	0.96	0.55	1	1	1	1
Prentis	0.94	0.94	0.96	1.10	1	1	1	1
Congresbury	0.95				1			
Dovercourt	0.95	1.03	1.10		1	1	1	
Foreman	0.95				1			
Garrington	0.95				1			
Lobley	0.95				1			
Mound	0.95	1.03			1	1		
Nelson Lake	0.95		0.58	0.58	1		1	1
Sullivan Lake	0.95	1.03			1	1		
Willesden Green	0.95				1			

APPENDIX B
(Continued)

Central Place	Functional Score				Hierarchical Level			
	1941	1951	1961	1971	1941	1951	1961	1971
Equity	1.41	1.41	1.44	1.65	1	1	1	1
Leahurst	1.41	1.41	0.96		1	1	1	
Netook	1.42	1.50	0.48		1	1	1	
Butte	1.53	1.61	1.68	0.58	1	1	1	1
Chedderville	1.53	1.61	1.68		1	1	1	
Dickson	1.53	3.46	4.12	3.91	1	1	1	1
Evarts	1.53	1.61	1.68		1	1	1	
Evergreen	1.53	1.61	1.68	0.58	1	1	1	1
Hillsdown	1.53	1.61	1.68	0.58	1	1	1	1
James River Bridge	1.53	1.61	1.68	2.22	1	1	1	1
Kevisville	1.53	1.61	1.68		1	1	1	
Knee Hill Valley	1.53	1.61	1.10		1	1	1	
Perbeck	1.53				1			
Springdale	1.53	0.58			1	1		
Stauffer	1.53	2.49	1.68	2.22	1	1	1	1
Talbot	1.53	1.61	1.68	0.58	1	1	1	1
Gilby	1.74	0.58	0.58	0.58	1	1	1	1
Codner	2.00	2.08	1.06	0.55	1	1	1	1
Forshee	2.00	2.08	2.13	1.13	1	1	1	1
Throne	2.00	2.08	2.16	2.22	1	1	1	1
Warden	2.00	2.08	1.58		1	1	1	
Withrow	2.00	3.20	1.58	0.55	1	1	1	1
Eagle Hill	2.11	2.19	2.26	0.58	1	1	1	1
Federal	2.47	2.55	2.64		1	1	1	
Morningside	2.47	2.55	2.64	5.05	1	1	1	2
Brownfield	2.54	1.61	2.50	3.18	1	1	1	1
Ardley	2.58	2.66	2.16	0.55	1	1	1	1
Leo	2.58	2.08	0.48		1	1	1	

APPENDIX B
(Continued)

Central Place	Functional Score				Hierarchical Level			
	1941	1951	1961	1971	1941	1951	1961	1971
Bingley	2.67	2.50	2.57	1.49	1	1	1	1
Loyalist	2.94	2.55	2.64	1.10	1	1	1	1
Raven	3.02	3.31	3.43	3.94	1	1	1	1
Reed Ranch	3.05	2.47	1.99	2.16	1	1	1	1
Harmattan	3.18	4.00	4.26	2.62	1	1	1	1
Fenn	3.21	3.67	4.39	2.30	1	1	1	1
Crammond	3.25	1.61	1.68	0.58	1	1	1	1
Hackett	3.38	4.45	0.96	0.55	1	1	1	1
Chigwell	4.42	4.44	4.05	1.68	1	2	1	1
Hespero	4.67	6.27	3.82	2.59	2	2	2	1
Menaik	4.71	4.22	4.09	3.67	2	2	1	1
Bulwark	4.79	3.96	3.60		2	1	1	
Leedale	4.90	4.64	1.68	0.58	2	2	1	1
Pine Lake	4.96	7.20	7.99	6.79	2	2	2	2
Scollard	5.21	2.08	2.16	0.55	2	1	1	1
Spruceview	5.31	6.76	7.79	11.22	2	2	2	2
Carlos	5.47	2.78	1.10		2	1	1	
Westward Ho	5.60	5.46	5.40	2.65	2	2	2	1
Hoadley	5.95	7.74	7.01	1.48	2	2	2	1
Fleet	6.65	6.47	3.12	3.87	2	2	1	1
Joffre	6.81	5.02	3.12	2.23	2	2	1	1
Haynes	6.90	5.82	4.05	3.17	2	2	1	1
Nevis	7.44	4.56	4.12	3.18	2	2	1	1
Gull Lake	8.87	5.02	4.00	9.07	2	2	1	1
Huxley	9.69	7.80	6.85	8.44	2	2	1	2
Tees	10.93	7.72	7.96	3.67	2	2	2	2
Lousana	11.19	11.16	6.93	5.86	2	2	2	1
Bluffton	11.38	14.43	10.48	6.66	2	2	2	2
Botha	11.72	11.19	8.91	4.83	2	2	2	2

APPENDIX B
(Continued)

Central Place	Functional Score 1941	Functional Score 1951	Functional Score 1961	Functional Score 1971	Hierarchical Level 1941	Hierarchical Level 1951	Hierarchical Level 1961	Hierarchical Level 1971
Benalto	12.71	19.05	25.47	13.55	2	2	2	2
Alhambra	12.93	6.63	3.37	4.35	2	2	1	1
Condor	13.36	11.70	5.86	5.73	2	2	2	2
Caroline	13.65	21.73	9.59	21.05	2	2	2	2
Blackfalds	14.21	16.48	37.66	18.11	2	2	3	2
Markerville	14.61	9.80	9.11	13.14	2	2	2	2
Torrington	14.68	21.71	22.59	11.38	2	2	2	2
Sundre	14.70	49.87	83.70	124.73	2	3	3	3
Red Willow	15.72	12.83	6.50	3.29	2	2	2	1
Rumsey	17.49	16.54	15.86	20.81	2	2	2	2
Wimborne	18.63	16.13	13.15	19.30	2	2	2	2
Penhold	20.55	28.16	19.06	21.71	2	2	2	2
Leslieville	21.57	19.37	13.97	9.91	2	2	2	2
Erskine	22.52	24.21	15.00	5.46	2	2	2	2
Byemoor	23.41	29.91	18.74	15.94	2	2	2	2
Gadsby	34.12	4[illegible].37	12.92	7.19	3	3	2	2
Endiang	34.84	27.10	11.79	7.09	3	2	2	2
Big Valley	35.31	35.91	68.35	25.55	3	3	3	2
Clive	39.11	36.57	18.56	15.84	3	3	2	2
Veteran	41.57	30.28	27.22	26.46	3	2	2	2
Elnora	43.50	46.44	46.70	39.35	3	3	3	3
Halkirk	46.15	26.50	18.89	17.59	3	2	2	2
Bowden	51.10	44.33	61.02	79.06	3	3	3	3
Alix	54.56	75.78	62.95	81.38	3	3	3	3
Donalda	56.26	35.81	42.23	26.44	3	3	3	2
Bentley	62.18	99.51	68.25	61.33	3	3	3	3
Alliance	67.37	79.63	53.36	44.30	3	3	3	3
Delburne	70.52	78.01	60.59	62.17	3	3	3	3

APPENDIX B
(Continued)

Central Place	Functional Score 1941	1951	1961	1971	Hierarchical Level 1941	1951	1961	1971
Eckville	73.82	91.26	98.80	112.32	3	3	3	3
Mirror	86.29	60.83	20.21	11.52	3	3	2	2
Castor	105.18	180.49	127.32	162.79	3	3	3	3
Sylvan Lake	105.91	174.86	147.01	125.61	3	3	3	3
Bashaw	119.05	110.25	126.87	135.20	3	3	3	3
Rimbey	122.27	188.97	191.51	218.94	3	3	3	3
Trochu	151.44	147.92	183.49	147.82	3	3	3	3
Rocky Mountain House	165.15	243.52	260.01	449.06	3	4	4	4
Coronation	179.67	160.50	205.23	172.98	3	3	3	3
Innisfail	333.51	279.15	320.17	354.32	4	4	4	4
Olds	464.35	441.86	590.20	607.94	4	4	4	4
Stettler	538.72	531.96	696.12	681.22	4	4	4	4
Lacombe	540.58	552.50	529.24	520.10	4	4	4	4
Ponoka	628.48	430.17	511.92	511.44	4	4	4	4
Red Deer	1,320.85	2,049.07	2,401.29	2,866.34	5	5	5	5

Source: Appendix A (see also text, pp. 62-64; 70-75).

APPENDIX C

NUMBERS OF PLACES IN WHICH FUNCTIONS OCCUR, BY LEVEL IN THE HIERARCHY, 1941-1971

Function	Hierarchical Level and Year																			
	1				2				3				4				5			
	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971
	61*	56	63	46	36	35	27	28	22	19	17	14	5	6	6	6	1	1	1	1
Grain elevator	26	27	36	22	28	30	21	21	22	18	16	13	5	6	6	5	1	1	1	1
General store	37	37	40	28	35	34	25	25	22	19	15	14	5	6	6	6	1	1	1	1
General auto. repair	1	1	3	5	22	23	18	10	22	19	15	14	5	6	6	6	1	1	1	1
Farm equipment	1				16	15	12	8	22	18	17	13	5	6	6	6	1	1	1	1
Machine shop	3	4	3	3	25	21	8	4	22	17	13	12	5	6	6	6	1	1	1	1
Post office	41	36	38	11	35	34	26	25	22	19	17	14	5	6	6	6	1	1	1	1
Restaurant	1	1	2	2	11	16	14	12	22	18	17	12	5	6	6	6	1	1	1	1
Service station	1	2	7	5	21	25	23	23	15	18	16	13	5	6	6	6	1	1	1	1
Bulk oil	1	1	3	2	11	17	21	19	19	18	16	14	5	6	6	6	1	1	1	1
Hardware					11	15	10	9	20	16	16	13	5	6	6	6	1	1	1	1
Meat market		1	1	1	12	8	5	3	20	18	14	10	5	6	6	6	1	1	1	1
Grocery	2	2	4	3	14	14	10	7	31	13	12	10	5	6	6	6	1	1	1	1
Building materials		1			8	13	10	10	20	18	17	12	5	6	6	6	1	1	1	1
Hotel					8	12	11	15	22	19	17	14	5	6	6	6	1	1	1	1
Auto. sales					1	3	1		13	17	15	14	5	6	6	6	1	1	1	1
Shoe repairs					3	4			18	13	6	1	5	6	5	3	1	1	1	1
Pool hall			1		8	12	5	2	19	14	13	3	5	6	6	4	1	1	1	1
Drug store					1	2	3		20	17	11	11	5	6	6	6	1	1	1	1
Physician									11	12	9	10	5	6	6	6	1	1	1	1
Bank					1	3	2	3	15	17	17	14	5	6	6	6	1	1	1	1
Law office						1	2	1	14	10	5	4	5	6	5	6	1	1	1	1
Creamery					2	1	2	2	14	14	13	7	5	6	6	5	1	1	1	1
Saddlery					4	1			14	1			5	2			1	1		
Bakery						1			12	10	9	7	5	6	6	6	1	1	1	1
Jewellery									6	7	8	7	5	6	6	6	1	1	1	1

APPENDIX C
(Continued)

	Hierarchical Level and Year																			
	1				2				3				4				5			
	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971
Function	61*	56	63	46	36	35	27	28	22	19	17	14	5	6	6	6	1	1	1	1
Beauty salon									1	7	8	12	5	6	6	6	1	1	1	1
Women's clothing					1			4	5	7	6	5	5	5	6	6	1	1	1	1
Household appliances					1	1	1		4	8	8	9	4	6	6	6	1	1	1	1
Insurance agency			1			2	2	6	6	12	14	12	3	6	6	6	1	1	1	1
Furniture									5	5	4	6	5	6	6	6	1	1	1	1
Less-than-daily newspaper									9	9	9	10	5	6	6	6	1	1	1	1
Funeral parlour									8	4	5	3	4	6	6	5	1	1	1	1
Men's clothing						1	1		4	4	4	6	4	6	6	6		1	1	1
General hospital									7	7	7	9	4	6	6	6	1	1	1	1
Electrical repairs						3	3		3	8	9	9	5	6	6	6	1	1	1	1
Farm supplies						2	2		1	7	8	11	5	5	6	6	1	1	1	1
Dentist									1	2	3	1	4	6	6	6	1	1	1	1
Tailor									5	2	1		3	2	1	1	1	1	1	1
Dry cleaning									3	1	1	5	4	6	5	6	1	1	1	1
Shoe shop						1			2	1	1	2	3	2	5	5	1	1	1	1
Variety store								4	2	6	11	11	4	6	6	6	1	1	1	1
Dry goods									1	2	1	1	3	5	6	5	1	1	1	1
Automobile parts									2	2	3	7	2	5	5	6	1	1	1	1
Photographic studio										2	3	2	3	4	6	5	1	1	1	1
Chiropractor												2	4	3	3	6	1	1	1	1
Liquor sales									1	1	6	8	2	4	6	6	1	1	1	1
District agriculturalist												1	3	4	6	5	1	1	1	1
Specialized auto. repair										3	3	5	1	6	6	6	1	1	1	1

APPENDIX C
(Continued)

	Hierarchical Level and Year																			
	1				2				3				4				5			
	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971
Function	61*	56	63	46	36	35	27	28	22	19	17	14	5	6	6	6	1	1	1	1
Public library							1			7	6	6	2	3	3	4	1	1	1	1
Family clothing										3	3	2	2	2	1	2	1	1	1	1
Confectionery									1	2	2		1	3	2	5	1	1		1
Accountant										3	1	3	1	3	6	6	1	1	1	1
Department store												2	1	2	5	5	1	1	1	1
Optician														2	3	6	1	1	1	1
Veterinary services											4	4	1	3	5	5		1	1	1
Children's clothing										3	2	1		1	4	2	1	1	1	
Household furnishings										1		1			1	1	1	1	1	1
Florist													1	3	4	6		1	1	1
Book shop															2	4	1	1	1	1
Psychiatric hospital													1	1	1	1		1	1	1
Tertiary education													1	1	1	1				1
Fuel											1	4			3	5		1	1	1
Sporting goods											2	3		1	3	5		1	1	1
Motorcycles												2			1	3		1	1	1
Physiotherapist														1		3		1	1	1
Monuments																		1	1	1
Upholstery repair															2	3		1	1	1
Music store												1			1	1		1	1	1
Nursing home												3			2	6		1	1	1
Car rental																		1	1	1
Trailer homes											1	1			1	2			1	1
Travel agency																2			1	1
Employment agency																1			1	1
Pet shop																			1	1

APPENDIX C
(Continued)

	Hierarchical Level and Year																			
	1				2				3				4				5			
	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971	1941	1951	1961	1971
Function	61*	56	63	46	36	35	27	28	22	19	17	14	5	6	6	6	1	1	1	1
Camera shop																				1
Daily newspaper																				1
Secretarial college																			1	1
Equipment rental																2				1
Toyshop																1				1
Antiques																				1
Health foods																				1
Marriage counselling																				1

*Number of centres in the class during the specified year.

Source: Appendix A(see also text, pp. 70-75).

APPENDIX D

FUNCTIONS OCCURRING IN THREE QUARTERS OR MORE OF CENTRES AT EACH LEVEL IN THE HIERARCHY

	Year			
Level	1941	1951	1961	1971
1	-	-	-	-
2	Grain elevator	Grain elevator	Grain elevator	Grain elevator
	General store	General store	General store	General store
	Post office	Post office	Post office	Post office
			Service station	Service station
			Bulk oil	
3	All the above, plus:			
	Farm equipment	Farm equipment	Farm equipment	Farm equipment
	General auto. repair	General auto. repair	General auto. repair	General auto. repair
	Machine shop	Machine shop	Machine shop	Machine shop
	Restaurant	Restaurant	Restaurant	Restaurant
		Service station		
	Bulk oil	Bulk oil		Bulk oil
	Hardware	Hardware	Hardware	Hardware
	Meat market	Meat market	Meat market	
	Building materials	Building materials	Building materials	Building materials
	Hotel	Hotel	Hotel	Hotel
		Auto. sales	Auto. sales	Auto. sales
	Shoe repairs			
	Pool hall		Pool hall	
	Drug store	Drug store		Drug store
		Bank	Bank	Bank
			Creamery	
			Insurance agency	Insurance agency
				Farm supplies
				Variety store
4	All the above, plus:			
	Service station			
	Grocery	Grocery	Grocery	Grocery
				Meat market
	Auto. sales			
		Shoe repairs	Shoe repairs	
		Pool hall		

APPENDIX D
(Continued)

Level	Year 1941	1951	1961	1971
4(Cont.)			Drug store	
	Physician	Physician	Physician	Physician
	Bank			
	Law office	Law office	Law office	Law office
	Creamery	Creamery		Creamery
	Saddlery			
	Bakery	Bakery	Bakery	Bakery
	Beauty salon	Beauty salon	Beauty salon	Beauty salon
	Jewellery	Jewellery	Jewellery	Jewellery
	Women's clothing	Women's clothing	Women's clothing	Women's clothing
	Household appliances	Household appliances	Household appliances	Household appliances
	Furniture	Furniture	Furniture	Furniture
		Insurance agency		
	Less-than-daily newpaper	Less-than-daily newspaper	Less-than-daily newspaper	Less-than-daily newspaper
	Funeral parlour	Funeral parlour	Funeral parlour	Funeral parlour
	General hospital	General hospital	General hospital	General hospital
	Men's clothing	Men's clothing	Men's clothing	Men's clothing
	Electrical repair	Electrical repair	Electrical repair	Electrical repair
	Dentist	Dentist	Dentist	Dentist
	Farm supplies	Farm supplies	Farm supplies	
	Dry cleaning	Dry cleaning	Dry cleaning	Dry cleaning
			Shoe sales	Shoe sales
	Variety store	Variety store	Variety store	
		Auto. parts	Auto. parts	Auto. parts
		Dry goods	Dry goods	Dry goods
			Photographic studio	Photographic studio
	Chiropractor			Chiropractor
			District agriculturalist	District agriculturalist
			Liquor sales	Liquor sales
				Confectionery
		Specialized auto.repair	Specialized auto.repair	Specialized auto.repair
			Accountant	Accountant
				Optometrist

APPENDIX D
(Continued)

Level	1941	1951	1961	1971
4(cont.)				
			Department store	Department store
				Florist
			Veterinary services	Veterinary services
				Fuel
				Sporting goods
				Nursing home
5	All the above (except men's clothing in 1941), plus:			
				Pool hall
	Insurance agency			
	Tailor	Tailor	Tailor	Tailor
	Shoe sales	Shoe sales		
	Auto. parts			
	Dry goods			
	Photographic studio	Photographic studio		
		Chiropractor	Chiropractor	
	District agriculturalist	District agriculturalist		
	Liquor sales	Liquor sales		
	Confectionery	Confectionery		
	Family clothing	Family clothing	Family clothing	Family cothing
	Library	Library	Library	Library
	Specialized auto.repair			
	Accountant	Accountant		
	Department store	Department store		
	Optometrist	Optometrist	Optometrist	
	Book shop	Book shop	Book shop	Book shop
	Children's clothing	Children's clothing	Children's clothing	
		Florist	Florist	Florist
	Furnishings	Furnishings	Furnishings	Furnishings
		Psychiatric hospital	Psychiatric hospital	Psychiatric hospital
				Tertiary education
		Veterinary services		

APPENDIX D
(Continued)

		Year		
Level	1941	1951	1961	1971
5(cont.)				
		Fuel	Fuel	
		Monuments	Monuments	Monuments
		Motorcycles	Motorcycles	Motorcycles
		Physiotherapy	Physiotherapy	Physiotherapy
		Sporting goods	Sporting goods	
		Auto. rental	Auto. rental	Auto. rental
		Music store	Music store	Music store
		Nursing home	Nursing home	
		Upholstery repair	Upholstery repair	Upholstery repair
			Trailer homes	Trailer homes
			Daily newspaper	Daily newspaper
			Employment agency	Employment agency
			Pet shop	Pet shop
			Secretarial college	Secretarial college
			Travel agency	Travel agency
				Equipment rental
				Toy shop
				Antiques
				Camera shop
				Health foods
				Marriage counselling

Source: Appendix A (see also text, pp. 70-75).

APPENDIX E

NUMBERS OF FUNCTIONS, ESTABLISHMENTS AND FUNCTIONAL UNITS IN THE CENTRAL PLACES OF THE RED DEER REGION, 1941-1971

Central Place	Functions 1941	Functions 1951	Functions 1961	Functions 1971	Establishments 1941	Establishments 1951	Establishments 1961	Establishments 1971	Functional Units 1941	Functional Units 1951	Functional Units 1961	Functional Units 1971
Cygnet	1				1				1			
Elspeth	1	1	1		1	1	1		1	1	1	
Mintlaw	1	1	1		1	1	1		1	1	1	
Niobe	1	1	1	1	1	1	1	1	1	1	1	1
Prevo	1	1	1		1	1	1		1	1	1	
Sabine*	1	1	1	1	1	1	1	1	1	1	1	1
Veldt	1	1	1		1	1	1		1	1	1	
Crestomere	1	1	1	1	1	1	1	1	1	1	1	1
Gwendale*	1	1	1	1	1	1	1	1	1	1	1	1
Homeglen	1	1	1		1	1	1		1	1	1	
New Hill	1	1	1		1	1	1		1	1	1	
Willowdale	1	1			1	1			1	1		
Lamerton	1	1	1		2	2	2		2	2	2	
June*	1	1	1	1	2	2	2	2	2	2	2	2
Oberlin*	1	1	1	1	2	2	2	1	2	2	2	1
Prentiss	1	1	1	1	2	2	2	2	2	2	2	2
Congresbury	1				1				1			
Dovercourt	1	1	1		1	1	1		1	1	1	
Foreman	1				1				1			
Garrington	1				1				1			
Lobley	1				1				1			
Mound	1	1			1	1			1	1		
Nelson Lake	1		1	1	1		1	1	1		1	1
Sullivan Lake	1	1			1	1			1	1		
Willesden Green	1				1				1			
Equity	1	1	1	1	3	3	3	3	3	3	3	3
Leahurst	1	1	1		3	3	2		3	3	2	
Netook	2	2	1		1	1	1		2	2	1	

APPENDIX E
(Continued)

Central Place	Functions 1941	Functions 1951	Functions 1961	Functions 1971	Establishments 1941	Establishments 1951	Establishments 1961	Establishments 1971	Functional Units 1941	Functional Units 1951	Functional Units 1961	Functional Units 1971
Butte	2	2	2	1	1	1	1	1	2	2	2	1
Chedderville	2	2	2		1	1	1		2	2	2	
Dickson	2	3	3	2	1	2	2	2	2	3	3	2
Evarts	2	2	2		1	1	1		2	2	2	
Evergreen	2	2	2	1	1	1	1	1	2	2	2	1
Hillsdown	2	2	2	1	1	1	1	1	2	2	2	1
James River Bridge	2	2	2	2	1	1	1	1	2	2	2	2
Kevisville	2	2	2		1	1	1		2	2	2	
Knee Hill Valley	2	2	1		1	1	1		2	2	1	
Perbeck	2				1				2			
Springdale	2	1			1	1			2	1		
Stauffer	2	3	2	2	1	2	1	1	2	3	2	2
Talbot	2	2	2	1	1	1	1	1	2	2	2	1
Gilby	1	1	1	1	3	1	1	1	3	1	1	1
Codner*	3	3	2	1	2	2	2	1	3	3	2	1
Forshee*	3	3	3	2	2	2	2	2	3	3	3	2
Throne*	3	3	3	2	2	2	2	1	3	3	3	2
Warden	3	3	2		2	2	1		3	3	2	
Withrow*	3	4	2	1	2	3	1	1	3	4	2	1
Eagle Hill	2	2	2	1	2	2	2	1	3	3	3	1
Federal	3	3	3		3	3	3		4	4	4	
Morningside	3	3	3	3	3	3	3	2	4	4	4	3
Brownfield	3	2	3	3	2	1	2	2	3	2	3	3
Ardley	3	3	3	1	3	3	2	1	4	4	3	1
Leo	3	3	1		3	2	1		4	3	1	
Bingley*	2	2	2	1	1	1	1	1	2	2	2	1
Loyalist	3	3	3	1	4	3	3	2	5	4	4	2
Raven	3	3	3	3	3	3	2	2	4	4	3	3
Reed Ranch	3	3	3	3	2	2	2	2	3	3	3	3

APPENDIX E
(Continued)

Central Place	Functions 1941	Functions 1951	Functions 1961	Functions 1971	Establishments 1941	Establishments 1951	Establishments 1961	Establishments 1971	Functional Units 1941	Functional Units 1951	Functional Units 1961	Functional Units 1971
Harmattan	4	4	4	2	2	3	2	1	4	5	4	2
Fenn	4	4	4	2	4	4	4	2	5	5	5	2
Crammond*	3	2	2	1	2	1	1	1	3	2	2	1
Hackett*	4	5	1	1	4	4	2	1	5	6	2	1
Chigwell	4	5	5	2	5	4	4	3	6	6	6	3
Hespero	4	6	4	3	5	6	4	3	6	8	5	4
Menaik	4	4	4	3	3	3	3	3	5	5	5	4
Bulwark	4	3	3		7	6	5		8	7	6	
Leedale	5	4	2	1	3	3	1	1	5	5	2	1
Pine Lake	4	6	6	6	3	5	5	4	4	6	7	6
Scollard*	6	3	3	1	3	2	2	1	6	3	3	1
Spruceview	4	5	6	6	4	5	6	6	5	5	7	6
Carlos	4	2	1		3	2	1		4	2	1	
Westward Ho	6	6	5	3	4	4	5	4	7	7	6	4
Hoadley	6	7	6	2	5	6	4	2	7	9	7	2
Fleet	5	5	3	3	7	7	4	4	8	8	5	5
Joffre	6	5	3	2	6	5	4	4	8	7	5	4
Haynes	6	7	5	4	7	5	4	4	9	8	6	5
Nevis	7	5	5	3	4	4	4	2	8	6	6	3
Gull Lake	6	4	3	4	5	4	4	4	7	5	4	5
Huxley	8	7	6	6	11	9	9	9	12	10	10	9
Tees	9	8	7	3	9	8	6	3	11	9	8	3
Lousana	9	9	7	6	10	9	7	5	12	11	9	7
Bluffton	8	9	7	5	7	9	6	3	10	11	7	5
Botha	10	10	8	4	11	9	8	5	13	13	12	6
Benalto	9	11	12	9	14	15	15	10	14	16	17	12
Alhambra	8	6	5	5	8	8	4	4	9	9	5	5
Condor	10	10	7	5	12	8	4	4	14	12	7	5
Caroline	7	11	8	11	7	10	8	13	10	13	9	14

APPENDIX E
(Continued)

Central Place	Functions 1941	Functions 1951	Functions 1961	Functions 1971	Establishments 1941	Establishments 1951	Establishments 1961	Establishments 1971	Functional Units 1941	Functional Units 1951	Functional Units 1961	Functional Units 1971
Blackfalds	9	11	14	11	11	11	19	12	13	14	22	14
Markerville	7	6	6	7	5	4	4	5	7	6	6	7
Torrington	10	13	13	8	15	17	19	11	16	18	21	12
Sundre	8	19	27	35	10	21	30	47	11	26	41	53
Red Willow	10	9	6	2	11	9	7	3	13	13	8	4
Rumsey	12	11	10	9	11	12	11	9	15	16	14	11
Wimborne	13	11	9	9	14	14	9	9	17	17	14	12
Penhold	12	15	12	13	12	17	16	15	16	22	20	19
Leslieville	12	13	11	7	16	12	10	8	20	17	13	10
Erskine	14	14	10	6	16	14	10	6	17	16	12	7
Byemoor	13	16	13	10	15	16	13	11	20	24	16	13
Gadsby	18	16	9	5	20	19	9	5	25	25	12	7
Endiang	14	12	8	6	14	11	8	6	19	14	10	8
Big Valley	18	19	18	13	19	20	17	14	24	27	24	16
Clive	16	17	12	10	24	26	17	15	32	31	20	16
Veteran	18	16	13	14	20	21	17	18	26	27	21	19
Elnora	20	21	21	18	23	26	25	19	30	30	32	25
Halkirk	17	17	13	10	19	17	14	14	24	21	18	15
Bowden	18	20	22	24	30	31	32	26	36	34	39	31
Alix	20	26	24	23	28	31	32	33	33	35	35	37
Donalda	20	18	20	13	28	25	25	16	35	31	30	18
Bentley	23	27	25	25	27	36	32	31	32	43	41	34
Alliance	23	27	19	17	32	34	30	24	36	40	34	27
Delburne	21	26	23	25	34	34	33	30	38	38	40	36
Eckville	23	29	30	29	38	44	42	43	42	51	52	50
Mirror	26	24	11	7	22	24	14	9	29	28	16	10
Castor	28	34	36	39	41	49	52	51	47	62	60	61
Sylvan Lake	28	38	32	32	40	52	47	44	49	62	56	48
Bashaw	29	31	33	37	47	44	47	52	53	56	51	58

APPENDIX E
(Continued)

Central Place	Functions				Establishments				Functional Units			
	1941	1951	1961	197	1941	1951	1961	1971	1941	1951	1961	1971
Rimbey	31	39	42	44	41	59	67	70	48	70	80	82
Trochu	30	32	37	39	42	45	48	48	49	55	63	57
Rocky Mountain House	33	39	44	54	48	66	80	116	60	82	98	138
Coronation	36	36	39	39	43	53	57	55	50	62	66	63
Innisfail	42	44	49	53	77	93	95	104	89	109	113	121
Olds	42	51	57	62	90	108	122	148	106	130	147	168
Stettler	47	52	59	62	100	125	159	168	107	138	178	187
Lacombe	45	53	56	61	97	130	131	135	110	150	151	155
Ponoka	45	49	54	56	93	114	138	136	114	135	155	157
Red Deer	56	69	72	81	148	254	354	483	173	294	405	523

*No longer in existence as a central place as of April, 1974.

Source: Appendix A (see also text, pp. 70-75).

APPENDIX F

TABLE 1

REVENUES OF POST OFFICES IN THE RED DEER REGION (CURRENT DOLLARS)[a]

Place	Year ended March 31											
	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Alhambra	480	528	572	619	662	635	629	690	736	971	1,178	1,284
Alix	3,688	4,336	4,667	4,554	4,938	5,253	6,514	6,990	7,071	11,060	12,276	12,102
Alliance	2,340	2,355	2,742	3,225	3,834	4,015	4,548	4,543	4,298	6,311	7,173	7,172
Ardley	352	304	295	325	244	223	213					
Bashaw	3,573	3,804	4,107	5,912	7,075	6,652	7,272	7,713	8,132	17,331	18,444	20,011
Benalto	745	672	677	961	1,062	1,035	1,023	1,158	1,137	1,605	2,096	2,071
Bentley	2,919	3,335	3,908	5,399	5,240	5,726	6,26[illegible]	6,627	6,951	11,631	13,270	13,693
Big Valley	2,747	2,745	2,683	3,303	4,135	4,253	3,177	3,637	3,424	4,925	5,663	6,059
Bingley	126	147	179	171	193	186	148	149	165			
Blackfalds	1,033	1,177	1,266	1,603	1,718	1,777	2,567	3,035	3,164	6,769	7,374	8,607
Bluffton	1,773	2,027	2,115	2,720	3,174	3,490	2,914	3,160	3,083	4,219	4,750	4,694
Botha	1,187	1,251	1,282	1,391	1,666	1,455	1,125	1,135	1,167	2,160	2,256	2,431
Bowden	3,162	4,641	8,598	8,308	11,241	12,013	22,832	26,232	28,734	75,232	73,019	89,433
Brownfield	440	375	301	484	522	639	507	593	[illegible]06	907	1,019	1,072
Bulwark	490	443	511	333	341	354	178	204	139			
Butte	220	247	309	184	353	426	161	162	169			
Byemoor	1,271	1,285	1,367	1,393	1,662	1,642	1,218	1,201	1,240	1,980	1,949	2,101
Carlos	48	71	81	138	135	144	76	110	101			
Caroline	502	534	666	1,399	1,790	2,183	2,117	2,329	2,194	5,641	6,104	7,403
Castor	4,579	5,284	5,772	8,637	9,725	9,585	10,266	10,366	10,877	22,335	24,072	27,643
Chedderville	280	254	152	136	164	136	93	101	106			
Chigwell	368	453	445	246	211	250	124	89	180			

APPENDIX F

TABLE 1 (Continued)

Place	Year ended March 31											
	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Clive	1,766	1,934	2,118	2,775	2,819	2,584	2,111	2,299	2,491	3,631	3,931	3,915
Codner	174	274	357	268	276	302						
Condor	752	998	1,073	842	969	1,087	1,083	1,260	1,266	1,356	1,316	1,361
Congresbury	63	59	83									
Coronation	5,324	5,659	5,684	7,265	8,572	9,020	9,382	9,943	10,271	19,620	22,604	25,758
Crammond	106	110	167	78	46	86	171	150	156			
Delburne	3,363	3,928	4,282	4,711	5,551	5,588	5,321	5,853	5,968	9,000	9,796	10,471
Dickson	386	416	454	1,065	1,082	1,015	1,047	1,010	1,112			
Donalda	2,573	2,706	3,037	3,737	4,407	4,083	3,553	3,742	3,713	5,134	5,493	5,756
Dovercourt	166	194	189	157	159	180	161	163	148			
Eagle Hill	241	202	236	399	463	433	134	84	57			
Eckville	3,791	4,266	4,432	5,764	6,512	6,610	8,595	9,305	9,980	17,968	20,562	22,127
Elnora	2,129	2,442	2,775	3,609	4,107	3,913	3,114	3,524	3,332	5,027	5,862	5,903
Endiang	1,114	1,175	1,180	1,131	1,301	1,184	731	728	616	1,142	1,210	1,191
Erskine	1,332	1,537	1,646	1,653	1,968	2,016	1,532	1,539	1,466	2,809	3,394	3,446
Evarts	700	690	589	292	324	373	275	267	256			
Evergreen	197	250	282	1,049	824	538	157	186	162			
Federal	215	157	233	196	227	202	391	310				
Fenn	319	322	436	322	369	407	324	337	368	300	347	364
Fleet	635	711	838	910	1,304	1,222	581	567	578	611	693	523
Foreman	56	40	45									
Forshee	308	274	252	282	343	352	231	269	258			
Gadsby	1,447	1,626	1,754	1,631	1,826	1,738	1,160	1,182	1,134	1,627	1,759	1,959

APPENDIX F

TABLE 1 (Continued)

Place	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Garrington	46	36	65									
Gull Lake	101	123	138	84	82	98						
Hackett	266	284	313	341	265	168						
Halkirk	1,466	1,600	1,725	2,265	2,471	2,334	2,052	2,077	2,660	2,490	2,545	2,834
Harmattan	363	417	462	458	527	546	469	504	646			
Haynes	327	320	348	449	512	469	404	367	417			
Hespero	528	552	581	296	384	448						
Hillsdown	274	201	305	384	524	608	360	435	650			
Hoadley	429	435	551	653	684	716	446	469	461			
Huxley	940	1,021	1,146	1,109	1,236	1,249	1,241	1,332	1,414	1,782	1,996	2,143
Innisfail	10,801	15,120	16,214	17,695	20,078	21,118	29,967	32,457	33,784	59,882	65,928	70,382
James River Bridge	157	164	181	279	262	251	255	279	243	1,062	1,372	1,447
Joffre	396	336	359	261	284	299	259	284				
Kevisville	162	179	210	302	320	338	437	474				
Knee Hill Valley	898	919	934	409	910	998	767	794	640			
Lacombe	15,800	17,642	17,980	28,440	32,653	34,416	46,018	47,495	47,641	85,570	102,274	108,251
Leedale	392	468	632	446	406	352	262	261	278			
Leo	203	207	234	168	176	181						
Leslieville	1,146	1,264	1,405	1,603	1,880	1,982	1,587	1,786	1,716	3,088	3,400	3,666
Lobley	50	53	55									
Lousana	1,253	1,314	1,447	1,512	1,740	1,798	1,260	1,299	1,187	1,965	2,154	2,191
Loyalist	479	413	524	331	384	351	315	343				
Markerville	793	999	1,153	957	1,078	1,078	727	868	898	1,089	1,243	1,288
Menaik	248	251	301	180	180	230	355	410	472	1,465	1,554	1,933
Mirror	2,557	2,720	2,841	3,260	3,573	3,301	2,825	2,827	2,574	3,107	3,266	3,429

(Years are "Year ended March 31".)

APPENDIX F

TABLE 1 (Continued)

Place	Year ended March 31											
	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Morningside	309	331	377	304	327	409	537	502	435	528	599	650
Mound	171	147	178	174	136	146						
Nelson Lake	26	28	25									
Netook	68	67	128	149	185	120						
Nevis	401	461	560	418	477	494	351	310	331	659	825	906
Olds	11,830	14,073	14,264	21,099	23,918	25,066	33,429	36,653	39,737	75,018	81,953	94,364
Penhold	1,651	10,370	9,941	2,036	2,799	4,013	2,405	2,531	2,617	4,255	4,546	5,199
Perbeck	75	66	62									
Pine Lake	439	466	440	468	539	514	442	534	531	803	887	1,026
Ponoka	12,033	14,098	14,127	24,385	28,989	30,957	40,844	42,536	46,092	77,355	90,250	103,978
Raven	210	241	276	224	331	375	265	367	403			
Red Deer	31,610	46,701	54,394	75,658	89,617	103,688	204,182	223,439	249,537	456,034	548,586	690,017
Red Willow	880	942	991	886	955	1,002	612	613	709	564	683	667
Rimbey	4,285	4,983	5,438	8,083	9,133	9,886	14,577	16,029	17,450	34,760	36,896	42,339
Rocky Mountain House	5,909	6,890	7,503	12,787	15,170	15,688	22,743	25,597	26,989	66,674	80,608	87,950
Rumsey	1,282	1,406	1,555	1,769	2,134	2,287	1,600	1,542	1,488	2,200	2,314	2,406
Scollard	517	552	604	376	437	532	240	224	207			
Springdale	216	147	154									
Stauffer	269	333	406	322	482	479	276	278	291	594	639	696
Stettler	11,236	12,732	12,501	24,872	30,177	33,522	43,624	46,203	47,729	89,663	101,672	113,948
Sullivan Lake	43	46	47	21	20	14						
Sundre	1,373	1,578	1,816	4,429	5,326	5,853	9,029	9,438	9,874	22,799	26,032	29,194
Sylvan Lake	3,795	4,670	5,431	6,658	7,424	8,444	9,243	10,089	10,720	19,189	22,658	25,204

APPENDIX F

TABLE 1 (Continued)

Place	Year ended March 31											
	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Talbot	220	213	272	145	143	127	136	107	133			
Tees	850	844	901	931	991	913	768	714	773	1,208	1,362	1,417
Throne	200	187	236	226	266	221	426	411	316	711	753	929
Torrington	515	562	582	821	840	891	1,013	1,071	1,344	2,167	2,455	2,786
Trochu	4,077	4,501	4,585	6,712	8,182	7,858	10,021	10,850	11,236	20,811	23,604	24,525
Veteran	1,473	1,570	1,730	2,094	2,255	2,249	2,796	3,003	3,198	5,606	6,387	7,970
Warden Junction	413	436	529	399	516	469	126					
Westward Ho	187	195	248	719	824	801	750	762	585			
Willesden Green	73	85	93									
Wimborne	580	610	755	1,181	1,153	1,423	990	1,056	1,005	1,634	1,821	1,880
Withrow	201	204	216	212	199	185	161					

[a] Revenues of offices which closed during a fiscal year are not shown for year in which closure occurred.

Sources: Post Office Department of Canada: Reports of the Postmaster General, years ended March 31, 1941, 1942, 1943, 1951, 1952, 1953; Ottawa.
Post Office Department of Canada: Lists of Post Offices with Revenues, years ended March 31, 1961, 1962, 1963; Ottawa.
Canada Post Office: Revenue Books, years ended March 31, 1971, 1972, 1973; unpublished.

APPENDIX F

TABLE 2

REVENUES OF POST OFFICES IN THE RED DEER REGION (1961 CONSTANT DOLLARS) AND PER CENT CHANGES OVER TIME

Place	Yearly Mean				Per Cent Change			
	1941/43	1951/53	1961/63	1971/73	1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Alhambra	868	832	685	541	-4.2	-17.7	-21.0	-37.7
Alix	6,929	6,400	6,858	5,583	-7.6	7.2	-18.6	-19.4
Alliance	4,084	4,806	4,463	3,254	17.7	-7.1	-27.1	-20.3
Ardley	523	344			-34.2			
Bashaw	6,306	8,523	7,706	8,788	35.2	-9.6	14.0	39.4
Benalto	1,150	1,327	1,106	909	15.4	-16.7	-17.8	-21.0
Bentley	5,580	7,103	6,614	6,080	27.3	-6.9	-8.1	9.0
Big Valley	4,489	5,074	3,413	2,622	13.0	-32.7	-23.2	-41.6
Bingley	249	238	154		-4.4	-35.3		
Blackfalds	1,909	2,240	2,922	3,584	17.3	30.4	22.7	87.7
Bluffton	3,249	4,073	3,052	2,152	25.4	-25.1	-29.5	-33.8
Botha	2,043	1,958	1,142	1,078	-4.2	-41.7	-5.6	-47.2
Bowden	9,006	13,699	25,933	37,442	52.2	89.3	44.4	315.7
Brownfield	612	714	569	472	16.7	-20.3	-17.1	-22.9
Bulwark	692	447	174		-43.6	-61.1		
Butte	426	420	164		-1.4	-61.0		
Byemoor	2,155	2,039	1,220	950	-5.4	-40.2	-22.1	-55.9
Carlos	110	182	96		65.5	-47.3		
Caroline	934	2,332	2,213	2,988	149.7	-5.1	35.0	219.9
Castor	8,586	12,130	10,503	11,665	41.3	-13.4	11.1	35.9
Chedderville	371	189	100			-49.1	-47.1	
Chigwell	695	307	131			-55.8	-57.3	

APPENDIX F

TABLE 2 (Continued)

Place	Yearly Mean 1941/43	1951/53	1961/63	1971/73	Per Cent Change 1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Clive	3,195	3,549	2,300	1,808	11.1	-35.2	-21.4	-43.4
Codner	426	367			-13.9			
Condor	1,550	1,258	1,203	636	-18.8	-4.4	-47.1	-59.0
Congresbury	112							
Coronation	9,153	10,789	9,865	10,709	17.9	-8.6	8.6	17.0
Crammond	211	91	159		-56.9	74.7		
Delburne	6,355	6,879	5,714	4,611	8.3	-16.9	-19.3	-27.4
Dickson	691	1,361	1,056		97.0	-22.4		
Donalda	4,566	5,307	3,669	2,581	16.2	-30.9	-29.7	-43.5
Dovercourt	301	215	157		-28.6	-27.0		
Eagle Hill	372	563	92		51.3	-83.7		
Eckville	6,859	8,202	9,293	9,555	19.6	13.3	2.8	39.3
Elnora	4,035	5,047	3,323	2,645	-17.6	-34.2	-20.4	-34.4
Endiang	1,904	1,569	692	558	-17.6	-55.9	-19.4	-70.7
Erskine	2,476	2,447	1,512	1,520	-1.2	-38.2	0.5	-38.6
Evarts	1,087	430	266		-60.4	-38.1		
Evergreen	400	1,047	168		161.8	-84.0		
Federal	333	271			-18.6			
Fenn	591	477	343	159	-19.3	-28.1	-53.6	-73.1
Fleet	1,199	1,374	575	288	14.6	-58.2	-49.9	-76.0
Foreman	77							
Forshee	458	424	253		-7.4	-40.3		
Gadsby	2,651	2,255	1,159	842	-14.9	-48.6	-27.4	-68.2
Garrington	81							

APPENDIX F

TABLE 2 (Continued)

Place	Yearly Mean 1941/43	1951/53	1961/63	1971/73	Per Cent Change 1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Gull Lake	200	115			-42.5			
Hackett	474	336			-29.1			
Halkirk	2,630	3,069	2,263	1,240	16.7	-26.3	-45.2	-52.9
Harmattan	682	664	540		-2.6	-18.7		
Haynes	547	621	396		13.5	-36.2		
Hespero	913	490			-46.3			
Hillsdown	428	658	482		53.7	-26.7		
Hoadley	765	891	459		16.5	-48.5		
Huxley	1,707	1,560	1,329	933	-8.6	-14.8	-29.8	-45.3
Innisfail	23,139	25,560	32,069	30,906	10.5	25.5	-3.6	33.6
James River Bridge	275	344	259	612	25.1	-24.7	136.3	122.5
Joffre	600	366			-39.0			
Kevisville	304	417			37.2			
Knee Hill Valley	1,511	1,005	734		-33.5	-27.0		
Lacombe	28,239	41,453	47,052	46,644	46.8	13.5	-0.9	65.2
Leedale	819	522	267		-32.3	-48.9		
Leo	354	228			-35.6			
Leslieville	2,095	2,372	1,696	1,600	13.2	-28.5	-5.7	-23.6
Lobley	87							
Lousana	2,204	2,191	1,249	994	-0.6	-43.0	-20.4	-54.9
Loyalist	778	462			-40.6			
Markerville	1,618	1,352	831	570	-16.4	-38.5	-31.4	-64.8
Menaik	440	257	412	780	-41.6	60.3	89.3	77.3

APPENDIX F

TABLE 2 (Continued)

Place	Yearly Mean 1941/43	1951/53	1961/63	1971/73	Per Cent Change 1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Mirror	4,457	4,398	2,742	1,544	-1.3	-37.7	-43.7	-65.4
Morningside	558	452	491	280	-20.8	8.6	-43.0	-49.8
Mound	272	198			-27.2			
Nelson Lake	43							
Netook	146	197			34.9			
Nevis	781	603	331	377	-22.8	-45.1	13.9	-51.7
Olds	22,058	30,418	36,606	39,404	37.9	20.3	7.6	78.6
Penhold	12,062	3,840	2,518	2,206	-68.2	-34.4	-12.4	-81.7
Perbeck	113							
Pine Lake	738	660	502	428	-10.6	-23.9	-14.7	-42.0
Ponoka	22,108	36,602	43,157	42,783	65.6	17.9	-0.9	93.5
Raven	399	404	345		1.3	-14.6		
Red Deer	72,875	116,620	225,719	266,956	60.0	93.6	18.3	266.3
Red Willow	1,545	1,233	645	302	-20.2	-47.7	-53.2	-80.5
Rimbey	8.076	11,673	16,019	18,115	45.7	36.2	13.1	124.3
Rocky Mountain House	11,148	18,943	25,110	37,056	69.9	32.6	47.6	232.4
Rumsey	2,329	2,686	1,543	1,090	15.3	-42.6	-29.4	-53.2
Scollard	920	583	224		-36.6	-61.6		
Springdale	234							
Stauffer	554	557	282	304	0.5	-49.4	7.8	-45.1
Stettler	20,026	38,443	45,852	48,091	92.0	19.3	4.9	140.1
Sullivan Lake	75	23			-69.3			
Sundre	2,618	6,775	9,447	12,291	158.8	39.4	30.1	369.5
Sylvan Lake	7,631	9,777	10,017	10,562	28.1	10.2	5.4	38.4
Talbot	387	180	125		-53.5	-30.6		

APPENDIX F

TABLE 2 (Continued)

Place	Yearly Mean				Per Cent Change			
	1941/43	1951/53	1961/63	1971/73	1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Tees	1,425	1,230	752	628	-13.7	-38.9	-16.5	-55.9
Throne	343	310	384	377	-9.6	23.9	-1.8	9.9
Torrington	912	1,108	1,143	1,167	21.5	3.2	2.1	28.0
Trochu	7,230	9,875	10,702	10,860	36.6	8.4	1.5	50.2
Veteran	2,622	2,863	2,999	3,145	9.2	4.8	4.9	19.9
Warden Junction	757	600			-20.7			
Westward Ho	345	1,017	699		194.8	-31.3		
Willesden Green	138							
Wimborne	1,068	1,630	1,017	840	52.6	-37.6	-17.4	-21.3
Withrow	342	259			-24.3			
RED DEER REGION	388,293	518,411	651,810	707,119	33.5	25.7	8.5	82.1

Sources: Post Office Department of Canada: Reports of the Postmaster General, years ended March 31, 1941, 1942, 1943, 1951, 1952, 1953; Ottawa.
Post Office Department of Canada: Lists of Post Offices with Revenues, years ended March 31, 1961, 1962, 1963; Ottawa.

APPENDIX F

TABLE 3

REVENUES OF POST OFFICES OUTSIDE THE RED DEER REGION (CURRENT DOLLARS)[a]

	Year ended March 31											
Place	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Acme	2,795	2,913	3,281	3,466	3,986	4,246	5,220	5,137	5,272	9,968	10,838	11.467
Airways	123	118	145	71	51	77						
Alder Flats	324	366	401	610	648	643	1,753	1,766	1,779	3,243	3,932	4,133
Allingham	139	146	168	160	168	219	97					
Alsike	35	46	44	114	124	147						
Altario	535	552	623	681	867	878	804	762	770	1,702	1,891	2,050
Amisk	1,139	1,145	1,187	1,377	1,561	1,624	1,330	1,459	1,501	2,033	2,219	2,546
Ankerton	115	103	113	155	163	139	111	106	84			
Antross	573	499	358									
Battle Bend	193	181	238									
Battle Lake	123	128	186	150	162	197	138	147	109			
Bawlf	2,169	2,233	2,381	2,732	2,852	3,723	1,951	1,870	1,820	2,767	2,866	2,980
Bearberry	218	231	264	225	258	255	144	130	137			
Beiseker	1,690	1,727	1,935	2,894	3,469	3,507	4,589	4,552	4,682	9,014	10,118	11,350
Bergen	181	200	319	240	212	254	168	160	167			
Big Prairie	166	175	157	171	161	206						
Bircham	526	583	603	314	318	320	208	222	215			
Bittern Lake	829	845	813	549	540	528	399	358	339	632	683	781
Bottrell	214	187	271	275	348	298	268	289	267			
Breton	1,581	1,786	2,218	2,912	3,238	2,314	3,374	3,845	4,218	9,381	10,484	11,711
Brightview	504	603	608	408	425	384	314	332	351			
Buck Lake						1,051	1,449	1,557	1,524	2,381	2,633	3,096
Camrose	19,743	25,397	28,315	39,564	45,639	52,571	76,6464	79,853	85,567	151,282	169,831	197,774

APPENDIX F

TABLE 3 (Continued)

Place	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
	Year ended March 31											
Carbon	3,174	3,416	3,225	3,912	4,433	4,774	4,097	4,079	4,264	7,221	8,272	8,709
Carstairs	4,296	4,704	5,009	6,217	6,685	7,069	9,031	9,035	9,810	19,154	22,134	24,328
Compeer	855	806	885	1,317	1,660	1,652	1,201	1,366	1,255	1,716	1,926	1,767
Consort	3,533	3,872	4,128	4,409	4,958	5,326	7,243	7,892	8,218	15,561	17,729	19,310
Craigmyle	2,323	2,374	2,405	2,358	2,815	2,724	1,995	1,880	1,804	2,021	2,067	1,893
Cremona	737	706	895	1,547	1,816	1,861	2,756	3,088	3,063	6,128	6,758	7,459
Crossfield	3,024	3,401	3,490	4,379	4,710	4,883	5,702	6,114	5,883	12,630	14,305	15,328
Czar	1,826	1,817	1,954	1,860	2,224	2,083	2,220	2,264	2,018	3,257	1,745	3,913
Daysland	3,404	3,506	3,756	4,990	5,903	6,484	6,639	7,245	7,421	13,040	13,890	14,158
Delia	3,174	3,443	3,562	3,417	4,046	4,021	3,882	3,958	4,146	5,580	6,635	7,441
Didsbury	7,585	8,378	8,824	13,361	15,279	14,779	17,697	20,[illegible]	20,214	42,621	47,562	54,162
Dogpound	408	453	426	238	256	273	237	323	334			
Dorenlee	578	521	483	363	370	333	252	253	258			
Dowling	138	139	173	133	154							
Drumheller	23,968	26,309	27,865	39,255	44,337	45.599	45,736	47,454	50,412	88,880	102,196	124,916
Duhamel	392	411	523	362	438	430						
Edberg	1,357	1,468	1,531	2,231	2,394	2,435	1,653	1,698	1,777	2,898	3,087	3,439
Elkton	83	100	126	228	242	247	260	244	208			
Falun	616	662	731	781	881	767	790	775	748	3,110	3,324	3,506
Ferintosh	1,293	1,413	1,653	1,797	1,964	2,100	1,290	1,181	1,224	2,093	2,564	2,621
Fisher Home	96	80	90	106	112	84	123	80	95			
Forestburg	2,136	2,183	2,373	3,872	4,331	4,420	4,832	5,523	5,708	13,193	14,936	16,518
Galahad	1,825	1,783	1,867	2,140	2,521	2,472	3,055	3,318	3,420	4,782	4,731	4,758
Garfield	131	170	191	157	177	169						

APPENDIX F

TABLE 3 (Continued)

Place	Year Ended March 31											
	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Ghost Pine Creek	256	285	251	384	373	463	456	440	395			
Grainger	256	255	274	194	203	229	347	301	297			
Gwynne	741	580	650	752	799	817	694	706	713	1,235	1,390	1,462
Hanna	10,772	12,251	12,784	16,904	20,485	21,119	26,782	27,061	28,314	47,856	57,630	60,355
Hardisty	3,735	3,993	4,205	5,435	6,235	6,379	6,389	6,422	6,546	11,758	13,874	14,458
Heisler	1,467	1,447	1,841	2,150	2,375	2,275	1,751	1,894	1,942	2,392	2,606	2,758
Hemaruka	442	471	593	382	427	381	319	351	329			
Hesketh	246	232	213	159	160	184	136	152	138			
Hobbema	513	635	569	1,141	1,302	1,307	1,343	1,290	1,250	3,503	4,051	5,349
Hughenden	[illegible],342	2,464	2,801	2,923	3,337	3,424	3,568	3,708	3,898	5,515	6,209	7,134
Idamay	31	33	37	33	33	56	43					
Kelsey	445	383	450	334	462	424	475	484	520	515	702	77
Kessler	62	57	71	100	128	95	50					
Killam	4,082	4,352	4,438	6,085	6,930	7,049	8,214	8,912	9,273	16,365	17,611	19,607
Kirriemuir	438	469	519	574	690	681	579	533	525	680	842	779
Linden				1,091	1,304	1,568	2,757	2,957	2,846	8,965	10,781	12,519
Little Gem	105	90	105	83	100	72						
Lloyds Hill	98	96	99	61	63	70	18					
Lougheed	2,772	2,758	2,996	2,650	3,053	3,012	2,300	2,344	2,275	4,208	4,816	4,990
Madden	367	360	378	496	468	615	828	853	869	1,116	1,194	1,309
Ma-Me-O Beach	151	169	173	815	980	1,108	735	783	800	1,244	1,364	1,532
Meeting Creek	1,117	1,059	1,160	1,688	1,763	1,808	1,434	1,499	1,375	1,589	1,498	1,608
Michichi	796	821	983	873	991	966	741	787	751	927		
Midlandvale	618	795	717	1,601	1,346	1,307						
Millet	3,088	3,559	3,887	4,802	5,214	5,467	4,535	5,092	5,066	7,774	9,178	9,846

APPENDIX F

TABLE 3 (Continued)

Place	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
	Year Ended March 31											
Monitor	649	640	733	774	886	963	946	1,020	881	1,534	1,640	1,570
Morrin	2,014	2,037	2,000	3,049	3,601	3,854	3,796	3,991	3,845	6,272	7,064	6,967
Mulhurst	205	275	352	245	252	404	590	793	764	2,181	2,804	2,511
Munson	1,073	1,154	1,197	920	1,079	1,077	749	677	586	1,272	1,492	1,613
Nacmine	1,066	1,321	1,364	810	874	921	710	517	527	663	710	646
Naco	323	304	386	294	317	277	87	69	86			
Neutral Hills	28	40	57	77	82	79	45	47				
New Brigden	623	651	723	615	695	664	617	651	691	930	989	1,026
New Norway	1,808	1,850	1,804	1,853	2,248	2,170	2,180	2,203	2,160	4,176	4,446	4,289
Norbuck	499	594	355	87	77	61	175	183	155			
Ohaton	860	762	894	1,295	1,401	1,653	1,411	1,543	1,733	2,818	2,857	3,015
Pemukan	262	226	225	110	94	100						
Pendryl	205	266	326	186	198	164	323	322	356			
Puffer	120	124	135	116								
Richdale	268	322	383	328	314	295	186	196	227			
Ricinus	91	99	234	238	209	238	219	216	260			
Rosalind	1,353	1,217	1,354	1,880	1,903	1,823	1,974	2,076	2,167	3,110	2,911	3,052
Rosyth	145	125	175	399	284	375						
Rowley	794	797	842	785	890	856	614	618	579	632	774	836
Scapa	700	630	702	723	621	500	255	249	244	336	355	427
Scotfield	242	188	213	267	297	283	268	260	221			
Sedalia	575	555	632	503	611	548	432	389	394	727	729	807
Sedgewick	4,116	4,327	4,784	8,525	9,305	10,125	8,969	9,246	9,165	14,473	16,337	17,062
Silver Heights	376	372	498	196	222	180	220	223	267			

APPENDIX F

TABLE 3 (Continued)

	Year Ended March 31											
Place	1941	1942	1943	1951	1952	1953	1961	1962	1963	1971	1972	1973
Sounding Lake	50	41	50	85	166							
Spondin	253	281	373	431	413	337	163	156	134			
Stanmore	276	228	191	175	175	231	169	150	134			
Strachan	71	85	82	39	42	60	53	43	56			
Strome	2,137	2,255	2,428	2,690	2,925	2,872	2,180	2,297	2,193	3,157	3,419	4,115
Sunnyslope	419	383	413	442	432	461	233	227	274			
Swalwell	1,249	1,373	1,561	1,186	1,411	1,460	926	962	1,044			
Three Hills	7,268	8,293	8,885	24,169	33,207	33,595	53,622	53,500	58,633	108,105	119,610	126,076
Twining	186	172	185	190	204	214	88					
Usona	88	85	99	110	146							
Waterglen	148	127	152									
Water Valley	201	223	234	385	476	508	346	344	399	848	1,078	1,321
Westcott	55	64	89	79	103	75	147	124	107			
Westerose	478	544	609	506	688	835	873	1,020	1,096	1,394	1,633	2,025
Wetaskiwin	17,422	18,210	19,677	30,274	36,001	29,826	53,846	58,583	62,282	117,402	134,927	148,597
Winfield	2,581	2,619	2,794	3,735	4,166	4,113	2,322	2,471	2,573	4,508	5,177	5,346
Watts	245	205	274	220	236	285						
Yeoford	124	163	121	101	128	147	125	109	91			
Youngstown	1,413	1,636	1,784	2,704	3,189	3,280	3,161	3,185	3,274	4,848	5,584	5,530

[a] Revenues of offices which closed during a financial year are not shown for year in which closure occurred.

Sources: Post Office Department of Canada: Reports of the Postmaster General, years ended March 31, 1941, 1942, 1943, 1951, 1952, 1953; Ottawa.
Post Office Department of Canada: Lists of Post Offices with Revenues, years ended March 31, 1961, 1962, 1963; Ottawa.
Canada Post Office: Revenue Books, years ended March 31, 1971, 1972, 1973; unpublished.

APPENDIX F

TABLE 4

REVENUES OF POST OFFICES OUTSIDE THE RED DEER REGION (1961 CONSTANT DOLLARS) AND PER CENT CHANGES OVER TIME

Place	Yearly Mean				Per Cent Change			
	1941/43	1951/53	1961/63	1971/73	1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Acme	4,936	5,077	5,210	5,084	2.9	2.6	-2.4	3.0
Airways	213	86			-59.6			
Alder Flats	600	826	1,766	1,781	37.7	113.8	0.8	196.8
Allingham	249	237			-4.8			
Alsike	69	167			142.0			
Altario	939	1,053	779	889	12.1	-26.0	14.1	-5.3
Amisk	1,906	1,980	1,430	1,071	3.9	-27.8	-25.1	-43.8
Ankerton	181	198	67		9.4	-66.2		
Antross	786							
Battle Bend	336							
Battle Lake	241	221	131		-8.3	-40.7		
Bawlf	3,725	4,039	1,880	1,357	8.4	-53.5	-27.8	-63.6
Bearberry	392	320	136		-18.4	-57.5		
Beiseker	2,939	4,284	4,608	4,802	45.8	7.6	4.2	63.4
Bergen	384	306	165		-20.3	-46.1		
Big Prairie	273	233			-14.7			
Bircham	941	413	215		-56.1	-47.9		
Bittern Lake	1,366	702	365	330	-48.6	-48.0	-9.6	-75.8
Bottrell	369	400	275		8.4	-31.3		
Breton	3,068	3,673	3,812	4,974	19.7	3.8	30.5	62.1
Brightview	942	529	332		-43.8	-37.2		
Buck Lake			1,510	1,277			-15.4	
Camrose	40,388	59,798	80,690	81,740	48.2	34.9	1.3	102.6
Carbon	5,390	5,694	4,147	3,812	5.6	-27.2	-8.1	-29.3

APPENDIX F

TABLE 4 (Continued)

Place	Yearly Mean				Per Cent Change			
	1941/43	1951/43	1961/63	1971/73	1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Carstairs	7,694	8,668	9,292	10,336	12.7	7.2	11.2	34.3
Compeer	1,399	2,009	1,274	852	43.6	-36.6	-33.1	-39.1
Consort	6,333	6,378	7,784	8,286	0.7	22.0	6.4	30.8
Craigmyle	3,900	3,427	1,893	942	-12.1	-44.8	-50.2	-75.8
Cremona	1,283	2,267	2,969	3,205	76.7	31.0	7.9	149.8
Crossfield	5,445	6,064	5,900	6,658	11.4	-2.7	12.8	22.3
Czar	3,074	2,677	2,167	1,719	-12.9	-19.0	-20.7	-44.1
Daysland	5,857	7,542	7,102	6,473	28.8	-5.8	-8.9	10.5
Delia	5,590	4,984	3,995	3,096	-10.8	-19.8	-22.5	-44.6
Didsbury	13,611	18,845	19,469	22,737	38.5	3.3	16.8	67.0
Dogpound	707	333	298		-52.9	-10.5		
Dorenlee	868	462	254		-46.8	-45.0		
Dowling	247							
Drumheller	42,911	56,073	47,867	49,778	30.7	-14.6	4.0	16.0
Duhamel	728	534			-26.6			
Edberg	2,392	3,064	1,709	1,484	28.1	-44.2	-13.2	-38.2
Elkton	170	302	237		77.6	-21.5		
Falun	1,104	1,055	771	1,566	-4.4	-26.9	103.1	41.8
Ferintosh	2,394	2,544	1,232	1,147	6.3	-51.6	-6.9	-52.1
Fisher Home	147	132	99		-10.2	-25.0		
Forestburg	3,675	5,479	5,354	7,033	49.1	-2.3	31.4	91.4
Galahad	3,007	3,096	3,264	2,248	3.0	5.4	-31.1	-25.2
Garfield	270	219			-18.9			
Ghost Pine Creek	435	530	430		21.8	-18.9		

APPENDIX F

TABLE 4 (Continued)

Place	Yearly Mean				Per Cent Change			
	1941/43	1951/53	1961/63	1971/73	1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Grainger	432	272	315		-37.0	15.8		
Gwynne	1,082	1,027	704	644	-5.1	-31.5	-8.5	-40.5
Hanna	19,664	25,395	27,386	26,125	29.1	7.8	-4.6	32.9
Hardisty	6,544	7,833	6,452	6,315	19.5	-17.6	-2.1	-3.6
Heisler	2,611	2,952	1,862	1,222	13.1	-36.9	-34.4	-53.2
Hemaruka	827	517	333		-37.5	-35.6		
Hesketh	379	219	142		-42.2	-35.2		
Hobbema	942	1,628	1,294	2,033	72.8	-20.5	57.1	115.8
Hughenden	4,178	4,203	3,724	2,971	0.6	-11.4	-20.2	-28.9
Idamay	56	57			1.8			
Kelsey	702	530	493	313	-24.5	-7.0	-36.5	-55.4
Kessler	104	141			36.6			
Killam	7,069	8,708	8,800	8,441	23.2	1.1	-4.1	19.4
Kirriemuir	783	844	546	362	7.8	-35.3	-33.7	-53.8
Linden		1,720	2,853	5,083		65.9	78.1	
Little Gem	165	111			-32.7			
Lloyds Hill	161	89			-44.7			
Lougheed	4,682	3,783	2,306	2,207	-19.2	-39.0	-4.3	-52.9
Madden	606	685	850	570	13.0	24.1	-32.9	-5.9
Ma-Me-O Beach	270	1,260	773	652	366.7	-38.7	-15.7	141.5
Meeting Creek	1,832	2,283	1,436	740	24.6	-37.1	-48.5	-59.6
Michichi	1,428	1,228	760		-14.0	-38.1		
Midlandvale	1,170	1,846			57.8			
Millet	5,784	6,720	4,898	4,222	16.2	-27.1	-13.8	-27.0

APPENDIX F

TABLE 4 (Continued)

Place	Yearly Mean				Per Cent Change			
	1941/43	1951/53	1961/63	1971/73	1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Monitor	1,110	1,138	949	747	2.5	-16.6	-21.3	-32.7
Morrin	3,323	4,559	3,877	3,198	37.2	-15.0	-17.5	-3.8
Mulhurst	456	391	716	1,181	-14.3	83.1	64.9	159.0
Munson	1,880	1,335	671	690	-29.0	-49.7	2.8	-63.3
Nacmine	2,059	1,130	585	318	-45.1	-48.2	-45.6	-84.6
Naco	557	385	81		-30.9	-79.0		
Neutral Hills	69	103			49.3			
New Brigden	1,097	857	653	464	-21.9	-23.8	-28.9	-57.7
New Norway	3,000	2,721	2,181	2,034	-9.3	-19.8	-6.7	-32.2
Norbuck	796	98	171		-87.7	74.5		
Ohaton	1,382	1,888	1,562	1,369	36.6	-17.3	-12.4	-0.9
Pemukan	392	132			-66.3			
Pendryl	438	238	334		-45.7	40.3		
Puffer	208							
Richdale	534	406	203		-24.0	-50.0		
Ricinus	232	297	232		28.0	-21.9		
Rosalind	2,155	2,434	2,012	1,429	12.9	-17.3	-29.0	-33.7
Rosyth	244	460			88.5			
Rowley	1,336	1,099	604	353	-17.7	-45.0	-41.6	-73.6
Scapa	1,115	801	249	176	-28.2	-68.9	-29.3	-84.2
Scotfield	353	367	250		4.0	-31.9		
Sedalia	967	721	405	356	-25.4	-43.8	-12.1	-63.2
Sedgewick	7,264	12,133	9,127	7,541	67.0	-24.8	-17.4	3.8
Silver Heights	684	259	230		-62.1	-8.5		

APPENDIX F

TABLE 4 (Continued)

Place	Yearly Mean 1941/43	1951/53	1961/63	1971/73	Per Cent Change 1941/43-1951/53	1951/53-1961/63	1961/63-1971/73	1941/43-1971/73
Sounding Lake	77							
Spondin	498	513	151		3.0	-70.6		
Stanmore	382	253	151		-33.8	-40.3		
Strachan	130	61	51		-53.1	-16.9		
Strome	3,745	3,639	2,223	1,684	-2.8	-38.9	-24.2	-55.0
Sunnyslope	667	579	245		-13.2	-57.7		
Swalwell	2,292	1.760	977	641	-23.2	-44.5	-34.4	-72.0
Three Hills	13,425	39,484	55,252	55,733	194.1	39.9	0.9	315.1
Twining	298	264			-11.4			
Usona	150							
Waterglen	234							
Water Valley	361	594	363	511	64.5	-38.9	40.8	41.6
Westcott	114	112	126		-1.8	12.5		
Westerose	896	880	996	796	-1.8	13.2	-25.1	-11.2
Wetaskiwin	30,372	46,051	58,237	63,158	51.6	26.5	8.5	107.9
Winfield	4,280	5,215	2,455	2,368	21.8	-52.9	-3.5	-44.7
Watts	397	322			-18.9			
Yeoford	224	163	108		-27.2	-33.7		
Youngstown	2,654	3,982	3,207	2,515	50.0	-19.5	-21.6	-5.2

Sources: Post Office Department of Canada: Reports of the Postmaster General, years ended March 31, 1941, 1942, 1943, 1951, 1952, 1953; Ottawa.
Post Office Department of Canada: Lists of Post Offices with Revenues, years ended March 31, 1961, 1962, 1963; Ottawa.
Canada Post Office: Revenue Books, years ended March 31, 1971, 1972, 1973; unpublished.

APPENDIX G

TRAVEL-TIME DISTANCES FROM EACH PLACE TO THE NEARER OF EDMONTON AND CALGARY, TO RED DEER AND TO TEN NEAREST NEIGHBOURS: 1941, 1951, 1961 (MINUTES)

Central Place	1941				Year 1951				1961			
	Edmonton	Calgary	Red Deer	Ten Nearest	Edmonton	Calgary	Red Deer	Ten Nearest	Edmonton	Calgary	Red Deer	Ten Nearest
Rocky Mtn. House		296	128	380		258	112	360		186	72	296
Codner	293		128	359								
Bingley	308		143	465	265		128	449				
Alhambra	274		106	317	244		92	295		174	60	241
Leslieville	269		107	293	226		92	280		177	63	264
Withrow	257		97	314								
Condor		255	87	267		228	74	236		163	49	207
Hespero		245	77	275								
Eckville	244		76	344	204		62	302		155	41	267
Carlos	279		143	527	240		128	518				
Leedale	246		125	507	208		102	442				
Hoadley	226		147	459	181		122	413				
Bluffton	216		123	494	181		103	459	159		79	399
Rimbey	204		99	461	176		84	430	154		62	366
Forshee	208		81	465	179		67	393				
Bentley	185		63	421	158		46	314	139		42	300
Gull Lake	172		50	398								
Sylvan Lake		207	39	384		182	29	323		135	21	257
Benalto		230	62	350		203	50	309		149	35	256
Dovercourt		288	136	364		235	117	337				
Evergreen		246	106	346		217	90	301				
Evarts		219	74	385		199	59	339				
Chedderville		274	154	426		224	131	376				
Butte		261	139	369		214	121	320				
Stauffer		240	119	370		213	102	319		151	74	275
Markerville		180	59	481		160	50	409		116	44	320
Caroline		241	143	378		198	116	303		148	79	244
Raven		219	110	381		188	[illegible]	320				
Crammond		220	143	403		182	118	336				
Kevisville		205	110	426								
Dickson		198	89	468		172	74	407				
James R. Bridge		199	125	403		166	105	363		136	88	340
Mound		168	104	342								

APPENDIX G (continued)

Central Place	1941 Edmonton	1941 Calgary	1941 Red Deer	1941 Ten Nearest	1951 Edmonton	1951 Calgary	1951 Red Deer	1951 Ten Nearest	1961 Edmonton	1961 Calgary	1961 Red Deer	1961 Ten Nearest
Sundre		172	129	322		143	112	296		114	89	281
Westward Ho		159	116	305		132	101	280				
Eagle Hill		144	102	404		125	88	353				
Harmattan		143	118	375		126	95	324				
Menaik	108		68	352	99		61	323	86		55	291
Ponoka	117		59	329	107		53	306	93		48	284
Morningside	133		43	321	122		38	273	106		35	259
Lacombe	149		27	288	136		24	215	119		22	218
Blackfalds	163		13	344	149		11	274		125	10	254
Red Deer		168	0	359		153	0	302		115	0	257
Penhold		151	17	358		137	16	313		105	14	278
Innisfail		135	33	376		122	31	336		92	23	280
Bowden		121	47	350		109	44	318		82	33	300
Netook		112	56	359								
Olds		101	67	356		92	61	290		73	49	289
Chigwell	153		52	352	135		42	264				
Clive	169		58	352	146		43	245	129		39	233
Tees	184		73	374	155		52	276	138		48	241
Bashaw	202		133	499	170		99	402	134		90	320
Mirror	211		108	433	176		73	343	157		67	292
Alix	202		91	372	171		68	312	148		58	235
Joffre	186		54	443								
Haynes	204		75	495	172		63	398				
Hillsdown		196	38	488		173	30	429				
Ardley	246		89	503								
Delburne		244	89	475		213	79	445		167	62	360
Pine Lake		196	62	559		173	52	478		131	40	398
Lousana		235	101	521		204	83	490		158	67	427
Knee Hill Valley		169	95	567		146	81	460				
Wimborne		179	116	531		151	97	430		118	82	404
Torrington		164	130	492		139	108	399		107	84	380
Elnora		258	124	520		220	104	531		177	86	476
Huxley		235	136	471		198	116	458		160	97	404

APPENDIX G (continued)

Central Place	1941				Year 1951				1961			
	Edmonton	Calgary	Red Deer	Ten Nearest	Edmonton	Calgary	Red Deer	Ten Nearest	Edmonton	Calgary	Red Deer	Ten Nearest
Trochu		217	154	452		181	133	411		145	112	362
Nevis	222		111	406	189		86	354	160		70	261
Erskine	240		129	432	205		102	375	170		80	274
Stettler	258		147	399	221		118	337	180		90	262
Warden	273		162	471								
Fenn	297		186	524	250		147	419	200		110	361
Big Valley	318		207	560	266		163	456		188	123	367
Scollard		310	231	636		269	182	515				
Rumsey		289	226	600		253	198	509		179	155	402
Donalda	247		187	563	205		153	464	171		136	410
Red Willow	274		175	592	226		150	489	190		117	407
Botha	281		170	434	242		139	368	193		103	296
Gadsby	301		190	486	261		158	419	205		115	336
Halkirk	324		213	542	282		179	498	218		128	373
Hackett	326		215	553								
Leo	358		247	659								
Byemoor		361	261	623	317		214	535		226	164	510
Endiang		364	279	644		330	235	586		229	174	527
Alliance	337	306	746	281			255	622	222		190	536
Castor	354		243	513	310		207	448	236		146	385
Sullivan Lake	413		302	815								
Fleet	377		266	514	331		228	464	249		159	404
Federal	397		286	516								
Bulwark	399		288	536	353		250	507				
Brownfield	404		324	555	340		286	511	260		204	445
Talbot	438		327	483	379		289	440				
Coronation	412		301	468	364		261	409	279		189	390
Throne	436		325	557	383		280	474	296		206	478
Veteran	460		349	501	402		299	442	313		223	512
Loyalist	484		373	540								

Source: See text, pp. 92-93.

APPENDIX H

TABLE 1

TIME-SPACE CONVERGENCE DATA, 1941-1951

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1941 (minutes)		Minutes Saved 1941-51	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1941	1951			
Rocky Mtn. House	380	352	28	135	0.207
Codner	359	338	21	124	0.169
Bingley	465	452	13	159	0.082
Alhambra	317	295	22	111	0.198
Leslieville	293	284	9	99	0.091
Withrow	314	285	29	106	0.274
Condor	267	238	29	98	0.296
Hespero	275	243	32	102	0.314
Eckville	344	313	31	121	0.256
Carlos	527	521	6	177	0.034
Leedale	507	419	88	170	0.518
Hoadley	459	375	84	151	0.556
Bluffton	494	402	92	168	0.548
Rimbey	461	396	65	164	0.396
Forshee	465	399	66	170	0.388
Bentley	421	321	100	164	0.610
Gull Lake	398	290	108	160	0.675
Sylvan Lake	384	324	60	150	0.400
Benalto	350	311	39	126	0.310
Dovercourt	364	305	59	125	0.472
Evergreen	346	301	45	116	0.388
Evarts	385	339	46	134	0.343
Chedderville	426	351	75	144	0.521
Butte	369	310	59	123	0.480
Stauffer	370	319	51	125	0.408
Markerville	481	409	72	168	0.429
Caroline	378	302	76	126	0.603
Raven	381	321	60	127	0.472
Crammond	402	320	82	134	0.612
Kevisville	426	370	56	142	0.394
Dickson	468	407	61	156	0.391
James River Bridge	403	322	81	135	0.600
Mound	342	298	44	116	0.379
Sundre	322	268	54	112	0.482
Westward Ho	305	254	51	105	0.486
Eagle Hill	404	343	61	142	0.430
Harmattan	375	327	48	130	0.369
Menaik	352	307	45	180	0.250

APPENDIX H

TABLE 1 (continued)

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1941 (minutes)		Minutes Saved 1941-51	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1941	1951			
Ponoka	329	277	52	154	0.338
Morningside	321	271	50	152	0.329
Lacombe	288	224	64	132	0.485
Blackfalds	344	286	58	171	0.339
Red Deer	359	303	56	174	0.322
Penhold	358	313	45	175	0.257
Innisfail	376	336	40	190	0.211
Bowden	350	300	50	167	0.299
Netook	359	308	51	172	0.297
Olds	356	295	61	174	0.351
Chigwell	352	264	88	131	0.672
Clive	352	251	101	131	0.771
Tees	374	287	87	139	0.626
Bashaw	499	406	93	167	0.557
Mirror	433	344	89	151	0.589
Alix	372	319	53	139	0.381
Joffre	443	359	84	152	0.553
Haynes	495	398	97	169	0.574
Hillsdown	488	429	59	182	0.324
Ardley	503	464	39	184	0.212
Delburne	475	433	42	178	0.236
Pine Lake	559	482	77	194	0.397
Lousana	521	469	52	193	0.269
Knee Hill Valley	567	460	107	206	0.519
Wimborne	531	430	101	180	0.561
Torrington	492	404	88	168	0.524
Elnora	520	465	55	192	0.287
Huxley	471	421	50	173	0.289
Trochu	452	403	49	165	0.297
Nevis	406	357	49	154	0.318
Erskine	432	375	57	162	0.352
Stettler	399	342	57	148	0.385
Warden	471	392	79	165	0.479
Fenn	524	423	101	178	0.567
Big Valley	560	456	104	188	0.553
Scollard	636	530	106	207	0.512
Rumsey	600	525	75	186	0.403
Donalda	563	475	88	188	0.468
Red Willow	592	507	85	208	0.409
Botha	434	368	66	158	0.418
Gadsby	486	419	67	179	0.374

APPENDIX H

TABLE 1 (continued)

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1941 (minutes)		Minutes Saved 1941-51	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1941	1951			
Halkirk	542	481	61	201	0.304
Hackett	553	470	83	187	0.444
Leo	659	568	91	221	0.412
Byemoor	623	543	80	209	0.383
Endiang	644	587	57	216	0.264
Alliance	746	609	137	254	0.539
Castor	513	448	65	189	0.344
Sullivan Lake	815	693	122	281	0.434
Fleet	514	470	44	184	0.239
Federal	516	473	43	187	0.230
Bulwark	536	507	29	182	0.159
Brownfield	555	511	44	186	0.237
Talbot	483	443	40	162	0.247
Coronation	468	409	59	163	0.362
Throne	557	474	83	189	0.439
Veteran	501	455	46	168	0.274
Loyalist	540	479	61	180	0.339

Source: see text pp. 92-93.

APPENDIX H

TABLE 2

TIME-SPACE CONVERGENCE DATA, 1951-1961

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1951 (minutes)		Minutes Saved 1951-61	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1951	1961			
Rocky Mtn. House	360	262	98	141	0.695
Bingley	449	324	125	159	0.786
Alhambra	295	207	88	111	0.793
Leslieville	280	209	71	100	0.710
Condor	236	169	67	99	0.677
Eckville	302	212	90	121	0.744
Carlos	518	386	132	183	0.721
Leedale	442	383	59	183	0.322
Hoadley	413	365	48	172	0.279
Bluffton	459	399	60	191	0.314
Rimbey	430	343	87	188	0.463
Forshee	393	309	84	186	0.452
Bentley	314	269	45	168	0.268
Sylvan Lake	323	249	74	149	0.497
Benalto	309	221	88	127	0.693
Dovercourt	337	275	62	137	0.453
Evergreen	301	243	58	116	0.500
Evarts	339	260	79	134	0.590
Chedderville	376	307	69	156	0.442
Butte	320	265	55	129	0.426
Stauffer	319	260	59	125	0.472
Markerville	409	312	97	168	0.577
Caroline	303	238	65	126	0.516
Raven	320	241	79	128	0.617
Crammond	336	282	54	148	0.380
Dickson	407	300	107	156	0.686
James River Bridge	363	314	49	154	0.318
Sundre	296	248	48	133	0.361
Westward Ho	280	236	44	125	0.352
Eagle Hill	353	298	55	153	0.360
Harmattan	324	256	68	139	0.489
Menaik	323	291	32	187	0.171
Ponoka	306	278	28	170	0.165
Morningside	273	246	27	156	0.173
Lacombe	215	194	21	127	0.165
Blackfalds	274	243	31	158	0.196
Red Deer	302	263	39	175	0.223
Penhold	313	269	44	171	0.257

APPENDIX H

TABLE 2 (continued)

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1951 (minutes)		Minutes Saved 1951-61	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1951	1961			
Innisfail	336	262	74	181	0.409
Bowden	318	272	46	173	0.266
Olds	290	259	31	169	0.183
Chigwell	264	232	32	131	0.244
Clive	245	221	24	134	0.179
Tees	276	243	33	153	0.216
Bashaw	402	307	95	171	0.556
Mirror	343	291	52	158	0.329
Alix	312	236	76	142	0.535
Haynes	398	342	56	169	0.331
Hillsdown	429	348	81	182	0.445
Delburne	445	330	115	185	0.622
Pine Lake	478	388	90	203	0.443
Lousana	490	398	92	203	0.453
Knee Hill Valley	460	409	51	206	0.248
Wimborne	430	378	52	180	0.289
Torrington	399	335	64	161	0.398
Elnora	531	457	74	221	0.335
Huxley	458	394	64	190	0.337
Trochu	411	335	76	171	0.444
Nevis	354	247	107	155	0.690
Erskine	375	251	124	162	0.765
Stettler	337	236	101	146	0.692
Fenn	419	317	102	179	0.570
Big Valley	456	340	116	188	0.617
Scollard	515	417	98	216	0.454
Rumsey	509	413	96	192	0.500
Donalda	464	413	51	190	0.268
Red Willow	489	403	86	206	0.418
Botha	368	261	107	158	0.677
Gadsby	419	304	115	179	0.643
Halkirk	498	374	124	209	0.593
Byemoor	535	437	98	212	0.462
Endiang	586	466	120	218	0.551
Alliance	622	536	86	261	0.330
Castor	448	341	107	189	0.566
Fleet	464	368	96	195	0.492

APPENDIX H

TABLE 2 (continued)

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1951 (minutes)		Minutes Saved	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1951	1961			
Bulwark	507	382	125	182	0.687
Brownfield	511	398	113	186	0.608
Talbot	440	347	93	163	0.571
Coronation	409	340	69	163	0.423
Throne	474	402	72	189	0.381
Veteran	442	385	57	169	0.337

Source: see text, pp. 92-93.

APPENDIX H

TABLE 3

TIME-SPACE CONVERGENCE DATA, 1961-1971

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1961 (minutes)		Minutes Saved 1961-71	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1961	1971			
Rocky Mtn. House	296	276	20	162	0.124
Alhambra	241	230	11	133	0.083
Leslieville	264	247	17	130	0.131
Condor	207	195	12	126	0.095
Eckville	267	241	26	154	0.169
Bluffton	399	331	68	191	0.356
Rimbey	366	303	63	192	0.328
Bentley	300	258	42	189	0.222
Sylvan Lake	257	228	29	160	0.181
Benalto	256	235	21	150	0.140
Stauffer	275	256	19	131	0.145
Markerville	320	297	23	170	0.135
Caroline	244	224	20	129	0.155
James River Bridge	340	310	30	169	0.178
Sundre	281	253	28	148	0.189
Menaik	291	261	30	187	0.160
Ponoka	284	258	26	176	0.148
Morningside	259	230	29	162	0.179
Lacombe	218	201	17	149	0.114
Blackfalds	254	228	26	171	0.152
Red Deer	257	226	30	176	0.171
Penhold	278	239	39	177	0.220
Innisfail	280	248	32	194	0.165
Bowden	300	274	26	201	0.129
Olds	289	262	27	191	0.141
Clive	233	207	26	139	0.187
Tees	241	212	29	151	0.192
Bashaw	320	248	72	180	0.400
Mirror	292	214	78	161	0.485
Alix	235	208	27	151	0.179
Delburne	360	285	75	208	0.361
Pine Lake	398	289	109	208	0.524
Lousana	427	306	121	222	0.545
Wimborne	404	314	90	191	0.471
Torrington	380	263	117	183	0.639

APPENDIX H

TABLE 3 (continued)

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1961 (minutes)		Minutes Saved	Aggregate Mileage	Convergence Rate (minutes saved per mile)
	1961	1971			
Elnora	476	344	132	241	0.548
Huxley	404	285	119	198	0.601
Trochu	362	266	96	190	0.505
Nevis	261	227	34	169	0.201
Erskine	274	232	42	179	0.235
Stettler	262	221	41	168	0.244
Fenn	361	317	44	211	0.209
Big Valley	367	326	41	214	0.192
Rumsey	402	350	52	204	0.255
Donalda	410	337	73	194	0.376
Red Willow	407	307	100	217	0.461
Botha	296	247	49	189	0.259
Gadsby	336	293	43	214	0.201
Halkirk	373	326	47	224	0.210
Byemoor	510	475	35	248	0.141
Endiang	527	470	57	262	0.218
Alliance	536	500	36	259	0.139
Castor	385	340	45	217	0.207
Fleet	404	333	71	221	0.321
Brownfield	445	372	73	208	0.351
Coronation	390	289	101	193	0.523
Throne	478	321	157	228	0.689
Veteran	512	352	160	234	0.684

Source: see text, pp. 92-93.

APPENDIX H

TABLE 4

TIME-SPACE CONVERGENCE DATA, 1941-1971

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1941 (minutes) 1941	1971	Minutes Saved	Aggregate Mileage	Convergence Rate (minutes saved per mile)
Rocky Mtn. House	380	235	145	135	1.074
Alhambra	317	199	118	111	1.063
Leslieville	293	194	99	99	1.000
Condor	267	158	109	98	1.112
Eckville	344	200	144	121	1.190
Bluffton	494	286	208	168	1.238
Rimbey	461	260	201	164	1.226
Bentley	421	232	189	164	1.152
Sylvan Lake	384	216	168	150	1.120
Benalto	350	206	144	126	1.143
Stauffer	370	243	127	125	1.016
Markerville	481	289	192	168	1.143
Caroline	378	223	155	126	1.230
James River Bridge	403	261	142	135	1.052
Sundre	322	200	122	112	1.089
Menaik	352	246	106	180	0.589
Ponoka	329	219	110	154	0.714
Morningside	321	209	112	152	0.737
Lacombe	288	182	106	132	0.803
Blackfalds	344	226	118	171	0.690
Red Deer	359	222	137	174	0.787
Penhold	358	237	121	175	0.691
Innisfail	376	241	135	190	0.711
Bowden	350	233	117	167	0.701
Olds	356	240	116	174	0.667
Clive	352	197	155	131	1.183
Tees	374	199	175	139	1.259
Bashaw	499	240	259	167	1.551
Mirror	433	214	219	151	1.450
Alix	372	197	175	139	1.259
Delburne	475	257	218	178	1.225
Pine Lake	569	281	278	194	1.433
Lousana	521	279	242	193	1.254
Wimborne	531	284	247	180	1.372

APPENDIX H

TABLE 4 (continued)

Central Place	Aggregate Travel-Time to Ten Nearest Neighbours as of 1941 (minutes) 1941	1971	Minutes Saved	Aggregate Mileage	Convergence Rate (minutes saved per mile)
Torrington	492	238	254	168	1.512
Elnora	520	289	231	192	1.203
Huxley	471	263	208	173	1.202
Trochu	452	247	205	165	1.242
Nevis	406	211	195	154	1.266
Erskine	432	212	220	162	1.358
Stettler	399	196	203	148	1.372
Fenn	524	293	231	178	1.298
Big Valley	560	303	257	188	1.367
Rumsey	600	334	266	186	1.430
Donalda	563	335	228	188	1.213
Red Willow	592	291	301	208	1.447
Botha	434	219	215	158	1.361
Gadsby	486	270	216	179	1.207
Halkirk	542	309	233	201	1.159
Byemoor	623	409	214	209	1.024
Endiang	644	415	229	216	1.060
Alliance	746	488	258	254	1.016
Castor	513	297	216	189	1.143
Fleet	514	297	217	184	1.179
Brownfield	555	336	219	186	1.177
Coronation	468	240	228	163	1.399
Throne	557	267	290	189	1.534
Veteran	501	281	220	168	1.310

Source: see text, pp. 92-93.